UNIT 2

Personal Protection

CHAPTER 2-1

Basic Survival Medicine

Medical Encounters

Foremost, among the many things which can compromise a survivor's ability to return are medical problems encountered. The most frequent injuries are fractures, strains, sprains, and dislocations, as well as burns and other types of wounds (fig. 2-1). Many survivors have difficulty in treating injuries and illness due to the lack of training and medical supplies.

Injuries and illnesses unusual to certain environments can reduce survival expectancy. In cold climates, and often in an open sea survival situation, exposure to extreme cold can produce serious tissue trauma, such as frostbite, or death from hypothermia. Exposure to heat in warm climates, and in certain areas on the open seas, can produce heat cramps, heat exhaustion, or life-threatening heatstroke.

A review of the survival experiences from World War II, Korea, and Southeast Asia indicates that, while U.S. military personnel generally knew how to administer first aid to others, there was a marked inability to administer self-aid. Further, only the most basic medical care had been taught to most military people. Lastly, it was repeatedly emphasized that even minor injuries or ailments, when ignored, became major problems in a survival situation. Thus, prompt attention to the most minor medical problem is essential in a survival episode. Applying principles of survival medicine should enable survivors to maintain health and well-being in a hostile or nonhostile environment until rescued.

Information in this chapter is a basic reference to self-aid techniques used by Prisoners of War in captivity and techniques found in folk medicine. The information describes procedures which can maintain health in medically harsh situations. It includes items used to prevent and treat injuries and illnesses. Because there is no "typical" survival situation, the approach to self-aid must be flexible, placing emphasis on using what is available to treat the injury or illness. Further, survivors recognize that medical treatment offered by people of other cultures may be far different from our own. For example, in the rural areas of Vietnam, a treatment made of snake meat was and is used to treat internal lower back pain. Such treatment may be displeasing to some people; however, medical aid offered to survivors in other cultures may be the best available in the given circumstance.

The procedures in this chapter must be viewed in the reality of a true survival situation. The results of treatment may be substandard compared with present medical standards. However, these procedures will not compromise professional medical care which becomes available following rescue. Moreover, in the context of a survival situation, they may represent the best available treatment to extend the individual's survival expectancy.

Procedures

Survival medicine encompasses procedures and expedients that are:

- Required and available for the preservation of health and the prevention, improvement, or treatment of injuries and illnesses encountered during survival.
- Suitable for application by nonmedical personnel in the circumstances of the survival situation.

Survival medicine is more than first aid in the conventional sense. It approaches final treatment in that it is not dependent upon the availability of technical medical assistance within a reasonable period of time.

Health Requirements

Personal Hygiene

In a survival situation, cleanliness is essential to prevent infection. Adequate personal cleanliness will not only protect against disease germs that are present in the individual's surroundings, but will also protect the group by reducing the spread of these germs (fig. 2-2).

Washing, particularly the face, hands, and feet, reduces the chances of infection from small scratches and abrasions. A daily bath or shower with hot water and soap is ideal. If no tub or shower is available, the body should be cleaned with a cloth and soapy water, paying particular attention to the body creases (armpits, groin, etc.), face, ears, hands, and feet. After this type of "bath," the body should be rinsed thoroughly with clear water to remove all traces of soap which could cause irritation.

Soap, although an aid, is not essential to keeping clean. Ashes, sand, fertile soil, and other expedients may be used to clean the body and cooking utensils.

When water is in short supply, the survivor should take an "air bath." All clothing should be removed and the body simply exposed to the air. Exposure to sunshine is ideal, but even on an overcast day or indoors, a 1-hour exposure of the naked body to the air will refresh the body. Care should be taken to avoid sunburn when bathing in this manner. Exposure in the shade, shelter, sleeping bag, etc., will help if the weather conditions do not permit direct exposure.

Hair should be kept trimmed, preferably 2 inches or less in length, and the face should be clean-shaven. Hair provides a surface for the attachment of parasites and the growth of bacteria. Keeping the hair short and the face clean-shaven will provide less habitat for these organisms. At least once a week, the hair should be washed with soap and water. When water is in short supply, the hair should be combed or brushed thoroughly and covered to keep it clean. It should be inspected weekly for fleas, lice, and other parasites. When parasites are discovered, they should be removed.

The principal means of infecting food and open wounds is contact with unclean hands. Hands should be washed with soap and water, if available, after handling any material which is likely to carry germs. This is especially important after each visit to the toilet, when caring for the sick and injured, and before handling food, food utensils, or drinking water. The fingers should be kept out of the mouth and the fingernails kept closely trimmed and clean. A scratch from a long fingernail could develop into a serious infection.

Care of the Mouth and Teeth

Application of the following fundamentals of oral hygiene will prevent tooth decay and gum disease.

The mouth and teeth should be cleansed thoroughly with a toothbrush at least once each day. When a toothbrush is not available, a "chewing stick" can be fashioned from a twig. The twig is washed, then chewed on one end until it is frayed and brush like. The teeth can then be brushed very thoroughly with the stick, taking care to clean all tooth surfaces. If necessary, a clean strip of cloth can be wrapped around the finger and rubbed on the teeth to wipe away food particles which have collected on them. When toothpaste is not available you can brush you teeth with small amounts of sand, salt, soap, or baking soda. Then rinse your mouth with water, salt water, or willow bark tea. Also, flossing you teeth with string or fiber helps oral hygiene.

Food debris which has accumulated between the teeth should be removed by using dental floss or tootpicks. The toothpicks can be fashioned from small twigs.

Gum tissues should be stimulated by rubbing them vigorously with a clean finger each day.

Use as much care cleaning dentures and other dental appliances, removable or fixed, as when cleaning natural teeth. Dentures and removable bridges should be removed and cleaned with a toothbrush or "chew stick" at least once each day. The tissue under the dentures should be brushed or rubbed regularly for proper stimulation. Removable dental appliances should be removed at night or for a 2- to 3-hour period during the day.

If you have cavities, you can make temporary fillings by placing candle wax, tobacco, aspirin, hot pepper, toothpaste or powder, or portions of ginger root into the cavity. Make sure you clean the cavity before placing a filling in the cavity.

Care of the Feet

Proper care of the feet is of the utmost important in a survival situation, especially if the survivor has to travel. Serious foot trouble can be prevented by observing the following simple rules:

The feet should be washed, dried thoroughly, and massaged each day. If water is in short supply, the feet should be "air cleaned" along with the rest of the body (fig. 2-3). Toenails should be trimmed straight across to prevent the development of ingrown toenails.

Boots should be broken in before wearing them on *any* mission. They should fit properly, neither so tight that they bind and cause pressure spots nor so loose that they permit the foot to slide forward and backward when walking. Insoles should be improvised to reduce any friction spots inside the shoes.

Socks should be large enough to allow the toes to move freely but not so loose that they wrinkle. Wool socks should be at least one size larger than cotton socks to allow for shrinkage. Socks with holes should be properly repaired before they are worn. Wearing sock with holes or socks that are poorly repaired may cause blisters. Clots of wool on the inside and outside should be removed from wool socks because they may cause blisters. Socks should be changed and washed thoroughly with soap and water each day. Woolen socks should be washed in cool water to lessen shrinkage. In camp, freshly laundered socks should be stretched to facilitate drying by hanging in the Sun or in an air current. While traveling, a damp pair of socks can be dried by placing them inside layers of clothing or hanging them on the outside of the pack. If socks become damp, they should be exchanged for dry ones at the first opportunity.

When traveling, the feet should be examined regularly to see if there are any red spots or blisters. If you get a small blister, do not open it. An intact blister is safe from infection. Apply a padding material around the blister to relieve pressure and reduce friction. If the blister bursts, treat it as an open wound. Clean and dress it daily and pad around it. Leave large blisters intact. To avoid having the blister burst or tear under pressure and cause a painful and open sore, do the following.

- Obtain a sewing-type needle and a clean or sterilized thread.
- Run the needle and thread through the blister after cleaning the blister.
- Detach the needle and leave both ends of the thread hanging out of the blister. The thread will absorb the liquid inside. This reduces the size of the hole and ensures that the hole does not close up.
- Pad around the blister.

Clothing and Bedding

Clothing and bedding can have disease germs which may be present on the skin, in the stool, in the urine, or in secretions of the nose and throat. Therefore, keeping clothing and bedding as clean as possible will decrease the chances of skin infection and decrease the possibility of parasite infestation. Outer clothing should be washed with soap and water when it becomes soiled. Under clothing and socks should be changed daily. If water is in short supply, clothing should be "air cleaned." For air cleaning, the clothing is shaken out of doors, then aired and sunned for 2 hours. Clothing cleaned in this manner should be worn in rotation. Sleeping bags should be turned inside out, fluffed, and aired after each use. Bed linen should be changed at least once a week, and the blankets, pillows, and mattresses should be aired and sunned (fig. 2-4).

Rest

Rest is necessary for the survivor because it not only restores physical and mental energy, but also promotes healing during an illness or after an injury.

In the initial stage of the survival episode, rest is particularly important. After those tasks requiring immediate attention are done, the survivor should inventory available resources, decide upon a plan of action, and

even have a meal. This “planning session” will provide a rest period without the survivor having a feeling of “doing nothing.”

If possible, regular rest periods should be planned in each day’s activities. The amount of time allotted for rest will depend on a number of factors, including the survivor's physical condition, the presence of hostile forces, etc., but usually, 10 minutes each hour is sufficient. During these rest periods, the survivor should change either from physical activity to complete rest or from mental activity to physical activity as the case may be. The survivor must learn to become comfortable and to rest under less than ideal conditions.

Rules for Avoiding Illness

In a survival situation, whether short-term or long-term, the dangers of disease are multiplied. Following simple guidelines regarding personal hygiene will enable the survivor to safeguard personal health and the health of others.

- All water obtained from natural sources should be purified before consumption.
- The ground in the camp area should not be soiled with urine or feces. Toilets should be used, if available. When no toilets are available, individuals should dig “cat holes” and cover their waste.
- Fingers and other infected objects should never be put into the mouth. Hands should be washed before handling any food or drinking water, before using the fingers in the care of the mouth and teeth, before and after caring for the sick and injured, and after handling any material likely to carry disease germs.
- After each meal, all eating utensils should be cleaned and disinfected in boiling water.
- The mouth and teeth should be cleansed thoroughly at least once each day. Most dental problems associated with long-term survival episodes can be prevented by using a toothbrush and toothpaste to remove food debris. If necessary, devices for cleaning the teeth should be improvised.
- Bites and insects can be avoided by keeping the body clean, by wearing proper protective clothing, and by using head net, improvised bed nets, and insect repellents.
- Wet clothing should be exchanged for dry clothing as soon as possible to avoid unnecessary body heat loss.
- Personal items such as canteens, pipes, towels, toothbrushes, handkerchiefs, and shaving items should not be shared with others.
- All food scraps, cans, and garbage should be removed from the camp area and buried.
- If possible, a survivor should get 7 or 8 hours of sleep each night.

Medical Emergencies

Medical problems and emergencies you may be faced with include breathing problems, severe bleeding, and shock.

Breathing Problems

Any one of the following can cause airway difficulty, resulting in stopped breathing:

- Foreign matter in mouth of throat that blocks the opening to the trachea.
- Face or neck injuries.
- Inflammation and swelling of mouth and throat caused by inhaling smoke, flames, and irritating vapors or by an allergic reaction.
- “Kink” in the throat (caused by the neck bent forward so that the chin rests upon the chest) may block the passage of air.
- Tongue blocks passage of air to the lungs upon unconsciousness. When an individual is unconscious, the muscles of the lower jaw and tongue relax as the neck drops forward, causing the lower jaw to sag and the tongue to drop back and block the passage of air.

Severe Bleeding

Severe bleeding from any major blood vessel in the body is extremely dangerous. The loss of 1 liter of blood will produce moderate symptoms of shock. The loss of 2 liters will produce a severe state of shock that

places the body in extreme danger. The loss of 3 liters is usually fatal.

Control Bleeding

In a survival situation, you must control serious bleeding immediately because replacement fluids normally are not available and the victim can die within a matter of minutes.

Immediate steps should be taken to stop the flow of blood, regardless of its source. The method used should be comparable with the type and degree of bleeding. The **tourniquet**, when required and properly used, will save life. If improperly used, it may cost the life of the survivor. The basic characteristics of a tourniquet and the methods of its use are well covered in standard first aid texts; however, certain points merit emphasis in the survival situation. A tourniquet should be used only after every alternate method has been attempted. If unable to get to medical aid within 2 hours, after 20 minutes, gradually loosen the tourniquet. If bleeding has stopped, remove the tourniquet; if bleeding continues, reapply and leave in place. The tourniquet should be applied as near the site of the bleeding as possible, between the wound and the heart, to reduce the amount of tissue lost.

External Bleeding

External bleeding falls into the following classifications (according to its source):

- ***Arterial.*** Blood vessels called arteries carry blood away from the heart and through the body. A cut artery issues *bright red* blood from the wound in *distinct spurts* or pulses that correspond to the rhythm of the heartbeat. Because the blood in the arteries is under high pressure, an individual can lose a large volume of blood in a short period when damage to an artery of significant size occurs. Therefore, arterial bleeding is the most serious type of bleeding. If not controlled promptly, it can be fatal.
- ***Venous***. Venous blood is blood that is returning to the heart through blood vessels called veins. A *steady flow of dark red, maroon, or bluish* blood characterizes bleeding from a vein. You can usually control venous bleeding more easily than arterial bleeding.
- ***Capillary***. The capillaries are the extremely small vessels that connect the arteries with the veins. Capillary bleeding most commonly occurs in minor cuts and scrapes. This type of bleeding is not difficult to control.

Tourniquet: A device used in controlling bleeding, consisting of a wide constricting band applied to the limb near to the site of bleeding; and between it and the heart.

You can control external bleeding by direct pressure, indirect (pressure points) pressure, elevation, digital ligation, or tourniquet.

Direct Pressure. The most effective way to control external bleeding is by applying pressure directly over the wound. This pressure must not only be firm enough to stop the bleeding, but it must also be maintained long enough to "seal off" the damaged surface.

If bleeding continues after having applied direct pressure for 30 minutes, apply a pressure dressing. This dressing consists of a thick dressing of gauze or to the suitable material applied directly over the wound and held in place with a tightly wrapped bandage (fig. 2-5). It should be tighter than an ordinary compression bandage but not so tight that it impairs circulation to the rest of the limb. Once you apply the dressing, *do not remove it*, even when the dressing becomes blood soaked.

Leave the pressure dressing in place for 1 or 2 days, after which you can remove and replace it with a smaller dressing.

In the long-term survival environment, make fresh, daily dressing changes and inspect for signs of infection.

Elevation. Raising an injured limb (arm or leg) as high as possible above the heart's level slows blood loss by aiding the return of blood to the heart and lowering the blood pressure at the wound. However, elevation alone will not control bleeding entirely; you

must also apply direct pressure over the wound. When treating a snakebite, however, keep the limb lower than the heart.

Pressure Points. A pressure point is a location where the main artery to the wound lies near the surface of the skin (fig. 2-6). You can use digital pressure on a pressure point to slow arterial bleeding until the application of a pressure dressing. Pressure point control is not as effective for controlling bleeding as direct pressure applied on the wound. It is rare when a single major compressible artery supplies a damaged vessel.

If you cannot remember the exact location of the pressure points, follow this rule: Apply pressure at the end of the joint just above the injured area. On hands, feet, and head, this will be the wrist, ankle, and neck, respectively.

WARNING

Use caution when applying pressure to the neck. Too much pressure for to long may cause unconsciousness or death. Never place a tourniquets around the neck.

Maintain pressure points by placing a round stick in the joint, bending the joint over the stick, and then keeping it tightly bent by lashing. By using this method to maintain pressure, it frees your hands to work in other areas.

Digital Ligation. You can stop major bleeding immediately or slow it down by applying pressure with a finger or two on the bleeding end of the vein or artery. Maintain the pressure until the bleeding stops or slows enough to apply a pressure bandage, elevation, and so forth.

Tourniquet. Use a tourniquet only when direct pressure over the bleeding point and all other methods did not control the bleeding. If you leave a tourniquet in place too long, the damage to the tissues can progress to **gangrene**, with a loss of the limb later. An improperly applied tourniquet can also cause permanent damage to nerves and other tissues at the site of the constriction.

Gangrene: Death of tissue, usually the result of loss of blood supply, and bacterial invasion.

If you must use a tourniquet, place it around the limb, between the wound and the heart, 5 to 10 centimeters above the wound site (fig. 2-7). Never place it directly over the wound or a fracture. Use a stick as a handle to tighten the tourniquet and tighten it only enough to stop blood flow. When you have tightened the tourniquet, bind the free end of the stick to the limb to prevent unwinding.

After you secure the tourniquet, clean and bandage the wound. A lone survivor *does not* remove or release an applied tourniquet. In a buddy system, however, the buddy can release the tourniquet pressure every 10 to 15 minutes for 1 or 2 minutes to let blood flow to the rest of the arm or leg to prevent limb loss.

Shock

Shock (intense stress reaction) is not a disease in itself. It is a clinical condition characterized by symptoms that arise when cardiac output is not enough to fill the arteries with blood under enough pressure to provide an adequate blood supply to the organs and tissues.

Circulatory Reaction

Shock in some degree accompanies all injuries to the body, and frequently it is the most serious consequence of the injury. In essence, shock is a circulatory reaction of the body (as a whole) to an injury (mechanical or emotional). While the changes to the circulatory system initially favor body resistance to the injury (by ensuring adequate blood supply to vital structures), they may progress to the point of circulatory failure and death. Students should be familiar with the signs and symptoms of shock so that the condition may be anticipated, recognized, and dealt with effectively. However, the best survival approach is to treat *all* moderate and severe injuries for shock. No harm will be done, and such treatment will speed recovery.

Fluids. Normally, fluids administered by mouth are generally prohibited in the treatment of shock following severe injury. Such fluids are poorly absorbed when given by mouth, and they may interfere with later administration of anesthesia for surgery. In survival medicine, however, the situation is different in that the treatment being given is the final treatment. Survivors cannot be denied of water for long periods just because they have been injured; in fact, their recovery depends upon adequate hydration. Small amounts of warm water, warm tea, or warm coffee given frequently early in shock are helpful if the patient is conscious, can swallow and has no internal injuries. In later shock, fluids by mouth are less effective as they are not absorbed from the intestines. Burns, particularly, require large amounts of water to replace fluid lost from injured areas. Alcohol should never be given to a person in shock or who may go into shock.

Psychogenic Shock. Psychogenic shock is frequently noted during the period immediately following an emergency. Psychogenic shock, which occurs even without injury, requires attention to limit it, both in degree and duration. The degree of this post-impact shock varies widely among individuals but its occurrence is almost universal. It is not uncommon, then, that some psychogenic reaction with circulatory implications occurs. Resistance to this type of shock depends upon the individual's personality and the amount of training previously received. Treatment consists of stopping all activities (when possible), relaxing, evaluating the situation, and formulating a plan of action before the survival situation begins.

Prevent and Treat Shock

Anticipate shock in all injured personnel. Treat all injured persons as follows, regardless of what symptoms appear (fig. 2-8).

- If the victim is conscious, place him on a level surface with the lower limbs elevated 15 to 20 centimeters.
- If the victim is unconscious, place him on his side or abdomen with his head turned to one side to prevent choking on vomit, blood, or other fluids.
- If you are unsure of the best position, place the victim perfectly flat. Once the victim is in a shock position, do not move him.
- Maintain body heat by insulating the victim from the surroundings and, in some instances, applying external heat.
- If wet, remove all the victim's wet clothing as soon as possible and replace with dry clothing.
- Improvise a shelter to insulate the victim from the weather.
- Use warm liquids or foods, a prewarmed sleeping bag, another person, warmed water in canteens, hot rocks wrapped in clothing, or fires on either of the victim to provide external warmth.
- If the victim is conscious, slowly administer small doses of a warm salt or sugar solution, if available.
- If the victim is unconscious or has abdominal wounds, do not give fluids by mouth.
- Have the victim rest for at least 24 hours.
- If you are a lone survivor, lie in a hole in the ground, behind a tree, or any other place out of the weather, with your head lower than your feet.
- If you are with a buddy, check your patient constantly.

Pain

Control of Pain. The control of pain alone with disease or injury under survival situations is both difficult and essential. In addition to its morale-breaking discomfort, pain contributes to shock and makes the survivor more vulnerable. Ideally, pain should be eliminated by the removal of the cause. However, this is not always immediately possible, hence measures for the control of pain are beneficial.

Position, Heat, and Cold. The part of the body that is hurting should be put at rest, or at least its activity restricted as much as possible. The position selected should be the

one giving the most comfort, and be the easiest to maintain. Splints and bandages may be necessary to maintain the **immobilization**. Elevation of the injured part, with immobilization, is particularly beneficial in the throbbing type pain like the "mashed" finger. Open wounds should be cleansed, foreign bodies removed, and a clean dressing applied to protect the wound from the air and chance contacts with environmental objects. Generally, the applying warmth reduces pain, for example a toothache. However, in some conditions, applying cold has the same effect, for example strains and sprains. Warmth or cold is best applied by using water due to its high specific heat, and the survivor can try both to determine which is most beneficial.

Pain Killers, Aspirin, APCs, and such tablets are primarily intended to combat the discomforts of colds and upper respiratory diseases, and, at best, will just take the edge off severe pain. They should be taken, however, if available. If no aspirin is available, there are some parts of vegetation which can be used. For example, most of the willows have been used for their pain-relieving and fever-lowering benefits for hundreds of years. Wintergreen, also known as checkerberry, was used by some Indians for body aches and pains. The leaves are made into a tea. The boiled bark of the magnolia tree helps relieve internal pains and fever, and has been known to stop dysentery.

Bone and Joint Injury

You could face bone and joint injuries that include fractures, dislocations, and sprains. Proper immobilization of fractures, dislocations, and sprains is even more important in survival medicine than in conventional first aid. Rather than merely making the patient comfortable during transport to eventual treatment, in survival medicine, the initial immobilization is part of the ultimate treatment. Immobilization in proper position hastens healing of fractures and improves the ultimate functional result. In the survival situation, the immobilization must suffice for a relatively long period of time and permit the patient to maintain a fairly high degree of mobility. Materials for splinting and bandaging are available in most survival situations, and proper techniques are detailed in most first aid manuals.

Immobilization: To reduce or eliminate motion of the body or a part by mechanical means or by strick bed rest.

Grating: A sound or feeling that occurs when broken bone ends rub together.

Fractures

There are basically two types of fractures: open and closed. With an open (or compound) fracture, the bone protrudes through the skin and complicates the actual fracture with an open wound. After setting the fracture, treat the wound as any other open wound.

The closed fracture has no open wounds. Follow the guidelines for immobilization, and set and splint the fracture.

The signs and symptoms of a fracture are pain, tenderness, discoloration, swelling deformity, loss of function, and **grating**. The reduction of fractures is normally beyond the scope of first aid; however, in the prolonged survival situation, the correction of bone deformities is necessary to hasten healing and obtain the greatest functional result. The best time for manipulation of a fracture is in the period immediately following the injury, before painful muscle spasms ensue. Traction is applied until overriding fragments of bone are brought into line, (check by the other limb) and the limb is firmly immobilized. Frequently, it is advantageous to continue traction after reduction to ensure the proper alignment of the bones.

The dangers with a fracture are the severing or the compression of a nerve or blood vessel at the site of fracture. For this reason minimum manipulation should be done, and only very cautiously. If you notice the area below the break becoming numb, swollen, cool to the touch, or turning pale, and the victim shows signs of shock, a major vessel may have been severed. You must control this internal bleeding. Treat the victim for shock, and replace lost fluids.

Often you must maintain traction during the splinting and healing process. You can effectively pull smaller bones such as the arm or lower leg by hand. You can create traction by wedging a hand or foot in the V-notch of a tree and pushing against the tree with the other limb. You can then splint the break.

Very strong muscles hold a broken thigh bone (**femur**) in place making it difficult to maintain traction during healing. You can make an improvised traction splint using natural material (fig. 2-9) as follows:

- Get two forked branches at least 5 centimeters in diameter. Measure one from the patient's armpit to 20 to 30 centimeters past his unbroken leg. Measure the other from the groin to 20 to 30 centimeters pass the unbroken leg. Ensure that both extend an equal distance beyond the end of the leg.

- Pad the two splints. Notch the ends without forks and lash a 20- to 30-centimeter cross member made from a 5-centimeter branch between them.

- Using available material (vines, cloth rawhide), tie the splint around the upper portion of the body and down the length of the broken leg. Follow the splinting guidelines.

- With available material, fashion a wrap that will extend around the ankle, with the two free ends tied to the cross member.

- Place a 10- by 2.5-centimeter stick in the middle of the free ends of the ankle wrap between the cross member and the foot. Using the stick, twist the material to make the traction easier.

- Continue twisting until the broken leg is as long or slightly longer than the unbroken leg.

- Lash the stick to maintain traction.

Note: *Over time you may lose traction because the material weakened. Check the traction periodically. If you must change or repair the splint, maintain the traction manually for a short time.*

Femur: The thigh bone, which extends from the pelvis to the knee.

Dislocations

Dislocations are the separations of bone joints causing the bones to go out of proper alignment. These misalignments can be very painful and can cause an impairment of nerve or circulatory function below the area affected. You must place these joints back into alignment as quickly as possible.

Signs and symptoms of dislocations are joint pain, tenderness, swelling, discoloration, limited range of motion, and deformity of the joint. You treat dislocations by reduction, immobilization, and rehabilitation.

Reduction or "setting" is placing the bones back into their proper alignment. Reduction of dislocated joints is done similar to that of fractures. Gentle, but firm, traction is applied and the limb is manipulated until it "snaps" back into place. The use of weights to pull the bones are the safest and easiest. If the survivor is alone, the problem is difficult but not impossible. Traction can still be applied by using gravity. The limb is tied to the fork of a tree. The weight of the body is then allowed to provide the necessary traction, with the joint being managed until the dislocation is reduced. Once performed, reduction decreases the victim's pain and allows for normal function and circulation. Without an X-ray, you can judge proper alignment by the look and feel of the joint and by comparing it to the joint on the opposite side.

Immobilization is nothing more than splinting the dislocation after reduction. You can use any material for a splint or you can splint a limb to the body. The basic guidelines for splinting are:

- Splint above and below the fracture site.
- Pad splints to reduce discomfort.
- Check circulation below the fracture after making each tie on the splint.

To rehabilitate the dislocation, remove the splints after 7 to 14 days. Gradually use the injured joint until fully healed.

Sprains

The accidental overstretching of a tendon or ligament causes sprains. The signs and symptoms are pain, swelling, tenderness, and discoloration (black and blue).

When treating sprains, think RICE:

R - Rest injured area.
I - Ice for 24 hours, then heat after that.
C - Compression-wrapping and/or splinting to help stabilize. If possible, leave the boot on a sprained ankle unless circulation is compromised.
E - Elevation of the affected area.

Wounds

Any physical injury causing a break in the skin is a wound. Wounds could be open wounds, skin diseases, frostbite, trench foot, and burns. A delay in treatment could cause infection.

Infection

Infection is a serious threat to the survivor. Delay in medical treatment of the survival situation increases the chances of wound infection. Antibiotics may not be available in sufficient amounts in the survival situation. In survival medicine, one must place more emphasis on the prevention and control of infection by applying techniques used before the advent of antibiotics.

Unfortunately, survivors have little control over the amount and type of infection introduced at the time of injury. However, they can help control the infection by wearing clean clothes. Use care to prevent additional infection into wounds. Wounds, regardless of the type or severity, should not be touched with dirty hands or objects. One exception to this rule is the necessary control of arterial bleeding. Clothing should be removed from wounds to avoid contamination surrounding skin areas.

All wounds should be promptly cleansed. Water is the most universally available cleaning agent, and should be (preferably) sterile. At sea level, sterilize water, by placing it in a covered container and boiling it for 10 minutes. Above 3,000 feet, water should be boiled for 1 hour (in a covered container) to ensure adequate sterilization. The water will remain sterile and can be stored indefinitely as long as it is covered.

Rinse the wounds rather than scrubbing to minimize additional damage to the tissue. Strange material should be washed from the wound to remove sources of continued infection. The skin next to the wounds should be washed thoroughly before bandaging.

While soap is not essential to clean wounds, a bar of medicated soap placed in a personal survival kit and used routinely would do much to prevent the infection of other injuries. External antiseptics are best used for cleaning abrasions, scratches, and the skin areas next to lacerations. Used in deep, larger wounds, antiseptics produce further tissue damage.

Nature also provides antiseptics which can be used for wound care. The American mountain ash is found from Newfoundland south to North Carolina and its inner bark has antiseptic forms. The red berries contain ascorbic acid and have been eaten to cure scurvy. The Sweet Gum bark is still officially recognized as being an antiseptic agent. Water from boiled Sweet Gum leaves can also be used as antiseptic for wounds.

Antibiotics

Antibiotics, when available, should be taken for the control of infection. Consensus is that the drug should be of the so-called “broad spectrum type;” that is, be effective against any micro-organism rather than specific for just 1 or 2 types. The exact amount to be included in survival kits will vary with the drug and basic assumptions as to the number and types of infections to be expected. Remember that antibiotics are dated items (shelf life about 4 years), and including them in survival kits requires kit inspection and drug replacement with active medical stocks.

Open Wounds

Open wounds are serious in a survival situation, not only because of tissue damage and blood loss, but also because they

may become infected. Bacteria on the object that made the wound, on the individual's skin and clothing, or on other foreign material or dirt that touches the wound may cause infection.

By taking proper care of the wound you can reduce further contamination and promote healing. Clean the wound as soon as possible after it occurs by:

- Removing or cutting clothing away from the wound.
- Always looking for an exit wound if a sharp object, gun shot, or projectile caused a wound.
- Thoroughly cleaning the skin around the wound.
- Rinsing (not scrubbing) the wound with large amounts of water under pressure. You can use fresh urine if water is not available.

The "open treatment" method is the safest way to manage wounds in survival situations. Do not try to close any wound by stitching or similar procedures. Leave the wound open to allow the drainage of any pus resulting from infection. In fact, it may be necessary to open the wound even more to avoid infection and to promote drainage. Adequate natural drainage of infected areas promotes healing. Generally, wicks or drains are unnecessary. On occasion, however, it may be better to remove excess pus and insert light, loose packing to ensure continuous drainage. A knife or other instrument used in making an incision for drainage must be sterilized to avoid introducing other types of organisms. The best way to sterilize in the field is with heat, dry or moist. As long as the wound can drain, it generally will not become life-threating, regardless of how unpleasant it looks or smells.

The term "open" does not mean that dressings should not be used. Good surgery requires that although wounds are not "closed," nerves, bone, and blood vessels should be covered with tissue. A notable exception to "open treatment" is the early closure of facial wounds which interfere with breathing, eating, or drinking. Wounds, left open, heal by forming an infection resistant tissue (proud flesh). This tissue is easily recognized by its moist red granular appearance, a good sign in any wound.

Dressings and Bandages. After cleansing, all wounds should be covered with a clean dressing. The dressing should be sterile; however, in the survival situation, any clean cloth will help to protect the wound from further infection. A proper bandage will anchor the dressing to the wound and afford further protection. Bandages should be snug enough to prevent slippage, yet not too tight. Slight pressure will reduce discomfort in most wounds and help stop bleeding. Once in place, dressings should not be changed too regularly unless required. External soiling does not reduce the effectiveness of a dressing, and pain and some tissue damage will accompany any removal. In addition, changing dressings increases the danger of infection.

If a wound is opening up more, you can bring the edges together with adhesive tape cut in the form of a "butterfly" or "dumbbell" (fig. 2-10).

In a survival situation, some degree of wound infection is almost impossible to prevent. Pain, swelling, and redness around the wound, increased temperature, and pus in the wound or on the dressing indicate infection is present.

To treat an infected wound:

- Place a warm, moist compress directly on the infected wound. Change the compress when it cools, keeping a warm compress on the wound for a total of 30 minutes. Apply the compresses three or four times daily.
- Drain the wound. Open and gently probe the infected wound with a sterile instrument.
- Dress and bandage the wound.
- Drink a lot of water.

Continue this treatment daily until all signs of infection have disappeared.

If you do not have antibiotics and the wound has become severely infected, does

not heal, and ordinary **debridement** is impossible, consider maggot therapy, despite its hazards:

- Expose the wound to flies for one day and then cover it.
- Check daily for maggots.
- Once maggots develop, keep wound covered but check daily.
- Remove all maggots when they have cleaned out all dead tissue and before they start on healthy tissue. Increased pain and bright red blood in the wound indicate that the maggots have reached healthy tissue.
- Flush the wound repeatedly with sterile water or fresh urine to remove the maggots.
- Check the wound ever four hours for several days to ensure all maggots have been removed.
- Bandage the wound and treat it as any the other wound. It should heal normally.

Lacerations: Lacerations (cuts) are best left open due to the probability of infection. Clean thoroughly, remove foreign material, and apply a protective dressing. Frequently, immobilization will hasten the healing of major lacerations. On occasion, it may be necessary to close (cover) the wound, despite the danger of infection, in order to control bleeding or increase the mobility of the patient. If a needle is available, thread may be procured from parachute lines, fabric, or clothing, and the wound closed by stitching. If stitching is required, place the stitches individually, and far enough apart to permit drainage of underlying parts. Do not worry about the way it looks. For scalp wounds, hair may be used to close after the wound is cleaned. Infection is less a danger in this area due to the rich blood supply.

Skin Diseases and Ailments

Although boils, fungal infections, and rashes rarely develop into a serious health problem, they cause discomfort and you should treat them.

Boils. Apply warm compresses to bring the boil to a head. Then open the boil using a sterile knife, wire, needle, or similar item. Thoroughly clean out the pus using soap and water. Cover the boil site, checking it periodically to ensure no further infection develops.

Debridement: To remove dirt, strange objects, damaged tissue, from a wound or a burn in order to prevent infection and to promote healing.

Fungal Infections. Keep the skin clean and dry, and expose the infected area to as much sunlight as possible. *Do not scratch* the affected area. During the Southeast Asian conflict, soldiers used antifungal powders, lye soap, chlorine bleach, alcohol, vinegar, concentrated salt water, and iodine to treat fungal infections with varying degrees of success. As with any "unapproved" method of treatment, use it with caution.

Rashes. To treat a skin rash effectively, first determine what is causing it. This determination may be difficult even in the best of situations. Observe the following rules to treat rashes:

- If it is moist, keep it dry.
- If it is dry, keep it moist.
- Do not scratch it.

Use a compress of vinegar or tannic acid made from tea or from boiling acorns or the bark of a hardwood tree to dry weeping rashes. Keep dry rashes moist by rubbing a small amount of animal fat or grease on the affected area.

Remember, treat rashes as open wounds and clean and dress them daily. There are many substances available to survivors in the wild or in captivity for use as antiseptics to treat wounds:

- *Iodine tablets*. Use 5 to 15 tablets in a liter of water to produce a good rinse for wounds during healing.
- *Garlic*. Rub it on a wound or boil it to extract the oils and use the water to rinse the affected area.
- *Salt water*. Use 2 to 3 tablespoons per liter of water to kill bacteria.
- *Bee honey*. Use it straight or dissolved in water.

- *Sphagnum moss*. Found in boggy areas worldwide, it is a natural source of iodine. Use as a dressing

Again, use noncommercially prepared materials with caution.

Frostbite

This injury results from frozen tissues. Light frostbite involves only the skin that takes on a dull, whitish look. Deep frostbite extends to a depth below the skin. The tissues become solid and immovable. Your feet, hands, and exposed facial areas are particularly vulnerable to frostbite.

When with others, prevent frostbite by using the buddy system. Check your buddy's face often and make sure that he checks yours. If you are alone, periodically cover your nose and lower part of your face with your mittens.

Do not try to thaw the affected areas by placing them close to an open flame. Gently rub them in lukewarm water. Dry the part and place it next to your skin to warm it at body temperature.

Trench Foot

This condition results from many hours or days of exposure to wet or damp conditions at a temperature just above freezing. The nerves and muscles sustain the main damage, but gangrene can occur. In extreme cases the flesh dies and it may become necessary to have the foot or leg **amputated**. The best prevention is to keep your feet dry. Carry extra socks with you in a waterproof packet. Dry wet socks against your body. Wash your feet daily and put on dry socks.

Burns

Burns, frequently encountered in aircraft accidents and subsequent survival episodes, pose serious problems. Burns cause severe pain, increase the probability of shock and infection, and offer an avenue for the loss of considerable body fluids and salts. Direct initial treatment toward relieving pain and preventing infection. Covering the wound with a clean dressing of any type reduces the pain and chance for infection. Further, such protection enhances the mobility of the patient and the capability for performing other vital survival functions. In burns about the face and neck ensure the victim has an open airway. If necessary, an emergency incision into the larynx should be done before the survivor develops extreme difficulties. Burns of the face and hands are particularly serious in a survival situation as they interfere with the capability of survivors to meet their own needs. Soaking certain barks (willow, oak, maple) in water soothes and protects burns by causing contraction of tissues when applied. This is a function of the acid content of the bark used.

Amputated: The surgical removal of a part of the body or a limb or part of a limb.

Electrolyte: A substance that when dissolved in a suitable liquid or when melted becomes an ionic conductor.

Maintenance of body fluids and salts is necessary to recover from burns. The only way to administer fluids in a survival situation is by mouth; hence the survivor should drink plenty of water early before the nausea and vomiting starts. Consuming the eyes and blood (both cooked) of animals can help restore **electrolyte** levels if salt tablets are not available.

NOTE: *The survivor may also pack salt in personal survival kits to replace electrolytes (1/4 teaspoon per quart of water).*

The following field treatment for burns relieves the pain somewhat, seems to help speed healing, and offers some protection against infection:

- First, stop the burning process. Put out the fire by removing clothing, dousing with water or sand, or by rolling on the ground. Cool the burned skin with ice or water. For burns caused by white phosphorous, pick out the white phosphorous with tweezers; do not douse with water.
- Soak dressings or clean rags for 10 inutes in a boiling tannic acid solution (obtained

from tea, inner bark of hardwood trees, or acorns boiled in water.
- Cool the dressings or clean rags and apply over burn.
- Treat as an open wound.
- Replace fluid loss.
- Maintain airway.
- Treat for shock.
- Consider using morphine, unless the burns are near the face.

Bites and Stings

Insects and related pests are hazards in a survival situation. They not only cause irritations, but they are often carriers of diseases, and cause severe allergic reactions in some individuals. Bites of insects, leeches, ticks, chiggers, etc., pose several hazards. Many of these organisms transmit diseases, and the bite itself is likely to become infected, especially if it itches and the survivor scratches it. In many parts of the world you will be exposed to serious, even fatal, diseases not encountered in the United States.

Ticks can carry and transmit diseases, such as Rocky Mountain spotted fever common in many parts of the United States. Ticks also transmit the Lyme disease.

Mosquitoes may carry malaria, dengue, and many other diseases.

Flies can spread disease from contact with infectious sources. They are causes of sleeping sickness, typhoid, cholera, and dysentery.

Fleas can transmit plague.

Lice can transmit typhus and relapsing fever.

The best way to avoid the complications of insect bites and stings is to keep immunizations (including booster shots) up-to-date, avoid insect-infested areas, use netting and insect repellent, and wear all clothing properly.

If you get bitten or stung, do not scratch the bite or sting, it might become infected. Inspect your body at least once a day to ensure there are no insects attached to you. If you find ticks attached to your body, cover them with a substance, such as Vaseline, heavy oil, or tree sap, that will cut off their air supply. Without air, the tick releases its hold, and you can remove it. Take care to remove the whole tick. Use tweezers if you have them. Grasp the tick where the mouth parts are attached to the skin. Do not squeeze the tick's body. These parasites can also be removed by applying heat or other irritant to them to encourage a relaxation of their hold on the survivor. Wash your hands after touching the tick. Clean the tick wound daily until healed.

Erythromycin: An antibacterial antibiotic.
Tetracycline: A broad spectrum antibiotic.

Treatment

It is impossible to list the treatment of all the different types of bites and stings. Treat bites and stings as follows:

- If antibiotics are available for your use, become familiar with them before deployment and use them.
- Predeployment immunizations can prevent most of the common diseases carried by mosquitoes and some carried by flies.
- The common fly-borne diseases are usually treatable with penicillin or **erythromycin**.
- Most tick-, flea-, louse-, and mite-borne diseases are treatable with **tetracycline**.
- Most antibiotics come in 250 milligram (mg) or 500 mg tablets. If you cannot remember the exact dose rate to treat a disease, 2 tablets, 4 times a day for 10 to 14 days will usually kill any bacteria.

Bee and Wasp Stings

If stung by a bee, immediately remove the stinger and venom sac, if attached, by scraping with a fingernail or a knife blade. Do not squeeze or grasp the stinger or venom sac, as squeezing will force more venom into the wound. Wash the sting site thoroughly with soap and water to lessen the chance of a secondary infection.

If you know or suspect that you are allergic to insect stings, always carry an insect sting kit with you.

Relieve the itching and discomfort caused by insect bites by applying:

- Cold compresses.
- A cooling paste of mud and ashes.
- Sap from dandelions.
- Coconut meat.
- Crushed cloves of garlic.
- Onion.

Regress: A retreat or backward movement in condition, signs or symptoms.

CPR: Cardiopulmonary resuscitation, a basic emergency procedure for life support, consisting of artificial respiration and manual external cardiac massage.

Necrosis: Tissue death that occurs in groups of cells in response to disease or injury.

Ulcer: A crater like lesion of the skin or mucous membrane resulting from necrosis.

Spider Bites and Scorpion Stings

The black widow spider is identified by a red hourglass on its abdomen. Only the female bites, and it has a neurotoxic venom. The initial pain is not severe, but severe local pain rapidly develops. The pain gradually spreads over the entire body and settles in the abdomen and legs. Abdominal cramps and progressive nausea, vomiting, and a rash may occur. Weakness, tremors, sweating, and salivation may occur. Anaphylactic reactions can occur. Symptoms begin to **regress** after several hours and are usually gone in a few days. Treat for shock. Be ready to perform **CPR**. Clean and dress the bite area to reduce the risk of infection. An antivenin is available.

The funnelweb spider is a large brown or gray spider found in Australia. The symptoms and the treatment for its bite are as for the black widow spider.

The brown house spider or brown recluse spider is a small, light brown spider identified by a dark brown violin on its back. There is no pain, or so little pain, that usually a victim is not aware of the bite. Within a few hours a painful red area with a blotch blue center appears. **Necrosis** does not occur in all bites, but usually in 3 to 4 days, a star-shaped, firm area of deep purple discoloration appears at the bite site. The area turns dark and dries up in a week or two. The margins separate and the scab falls off, leaving an open **ulcer**. Secondary infection and regional swollen lymph glands usually become visible at this stage. The outstanding characteristic of the brown recluse bite is an ulcer that does not heal but persists for weeks or months. In addition to the ulcer, there is often a systemic reaction that is serious and may lead to death. Reactions (fever, chills, joint pain, vomiting, and a generalized rash) occur chiefly in children or weak and tired persons.

Tarantulas are large, hairy spiders found mainly in the tropics. Most do not inject venom, but some South American species do. They have large fangs. If bitten, pain and bleeding are certain, and infection is likely. Treat a tarantula bite as for any open wound, and try to prevent infection. If symptoms of poisoning appear, treat as for the bite of the black widow spider.

Scorpions are all poisonous to a greater or lesser degree. There are two different reactions, depending on the species:

- Severe local reaction only, with pain and swelling around the area of the sting. Possible prickly sensation around the mouth and a thick-feeling tongue.
- Severe systemic reaction, with little or no visible local reaction. Local pain may be present. Systemic reaction includes respiratory difficulties, thick-feeling tongue, body spasms, drooling, gastric distention, double vision, blindness, involuntary rapid movement of the eyeballs, involuntary urination and defecation, and heart failure. Death is rare, occurring mainly in children and adults with high blood pressure or illnesses.

Treat scorpion stings as you would a black widow bite.

Snakebites

The chance of a snakebite in a survival situation is rather small, if you are familiar with the various types of snakes and their habitats. However, it could happen and you

should know how to treat a snakebite. Deaths from snakebites are rare. More than one-half of the snakebite victims have little or no poisoning, and only about one-quarter develop serious systemic poisoning. However, the chance of a snakebite in a survival situation can affect morale, and failure to take preventive measures or failure to treat a snakebite properly can result in needless tragedy.

The primary concern in the treatment of snakebite is to limit the amount of eventual tissue destruction around the bite area.

A bite wound, regardless of the type of animal that inflicted it, can become infected from bacteria in the animal's mouth. With nonpoisonous as well as poisonous snakebites, this local infection is responsible for a large part of the damage that results.

Snake venoms not only contain poisons that attack the victim's central nervous system and blood circulation, but also digestive enzymes to aid in digesting their prey. These poisons can cause a very large area of tissue death, leaving a large open wound. This condition could lead to the need for eventual amputation if not treated.

Shock and panic in a person bitten by a snake can also affect the person's recovery. Excitement, hysteria, and panic can speed up the circulation, causing the body to absorb the toxin quickly. Signs of shock occur within the first 30 minutes after the bite.

Before you start treating a snakebite, determine whether the snake was poisonous or nonpoisonous. Bites from a nonpoisonous snake will show rows of teeth. Bites from a poisonous snake may have rows of teeth showing, but will have one or more distinctive puncture marks caused by fang penetration. Symptoms of a poisonous bite may be spontaneous bleeding from the nose and anus, blood in the urine, pain at the site of the bite, and swelling at the site of the bite within a few minutes or up to 2 hours later.

Breathing difficulty, paralysis, weakness, twitching, and numbness are also signs of neurotoxic venoms. These signs usually appear 1.5 to 2 hours after the bite.

If you determine that a poisonous snake bit an individual, take the following steps:

- Reassure the victim and keep him still.
- Set up for shock and force fluids or give
- an intravenous (IV).
- Remove watches, rings, bracelets, or other constricting items.
- Clean the bite area.
- Maintain an airway (especially if bitten near the face or neck) and be prepared to administer mouth-to-mouth resuscitation or CPR.
- Use a constricting band between the wound and the heart.
- Immobilize the site.
- Remove the poison as soon as possibly using a mechanical suction device or by squeezing.

Do not:

- Give the victim alcoholic beverages or tobacco products.
- Give morphine or other central nervous system (CNS) depressors.
- Make any deep cuts at the bite site. Cutting opens capillaries that in turn open a direct route into the blood stream for venom and infection.

Note: *If medical treatment is over one hour away, make an incision (no longer than 6 millimeters and no deeper than 3 millimeters) over each puncture, cutting just deep enough to enlarge the fang opening, but only through the first or second layer of skin. Place a suction cup over the bite so that you have a good vacuum seal. Suction the bite site 3 to 4 times. Use mouth suction* ***only as a last resort and only if you do not have open sores in your mouth****. Spit the envenomed blood out and rinse your mouth with water. This method will draw out 25 to 30 percent of the venom.*

- Put your hands on your face or rub your eyes, as venom may be on your hands. Venom may cause blindness.
- Break open the large blisters that form around the bite site.

After caring for the victim as described above, take the following actions to minimize local effects:

- If infection appears, keep the wound open and clean.

- Use heat after 24 to 48 hours to help prevent the spread of local infection. Heat also helps to draw out an infection.
- Keep the wound covered with a dry, sterile dressing.
- Have the victim drink large amounts of fluids until the infection is gone.

Vital Injuries

Head Injuries

Injuries to the head pose additional problems related to brain damage as well as interfering with breathing and eating. Bleeding is more heavy flowing in the face and head area, but infections have more difficulty in taking hold. This makes it somewhat safer to close such wounds earlier to maintain function. An emergency incision into the larynx to open the airway may be necessary if breathing becomes difficult due to difficulty of the upper airways. In the event of unconsciousness, watch the patient closely and keep him or her still. Even in the face of mild or near shock, keep the head level or even slightly elevated if there is reason to expect brain damage. Do not give fluids or morphine to unconscious persons.

Abdominal Wounds

Wounds of the abdomen are particularly serious in the survival situation. Such wounds, without immediate and adequate surgery, have an extremely high mortality rate and render patients totally unable to care for themselves. If intestines are not coming out through the wound, a secure bandage should be applied to keep this from occurring. If intestines are coming out, do not replace it due to the almost certain threat of fatal peritonitis. Cover the intestine with a large dressing and keep the dressing wet with any fluid that is fit to drink, or urine. The patient should lie on the back and avoid any motions that increase intra-abdominal pressure which might cause more intestine to come out. Keep the survivor in an immobile state or move on a litter. “Nature” will eventually take care of the problem; either through death, or walling-off of the damaged area.

Pleural Cavity: The cavity within the thorax that contains the lungs.

Chest Injuries

Injuries of the chest are common, painful and disabling. Severe bruises of the chest or fractures of the ribs require that the chest be immobilized to prevent large painful movements of the chest wall. The bandage is applied while the patient deeply exhales. In the survival situation, it may be necessary for survivors to wrap their own chest. This is more difficult but can be done by attaching one end of the long bandage (parachute material) to a tree or other fixed object, holding the other end in the hand, and slowly rolling the body toward the tree, keeping enough counterpressure on the bandage to ensure a tight fit.

Sucking Chest Wounds

These wounds are easily recognized by the sucking noise and appearance of foam or bubbles in the wound. These wounds must be closed immediately before serious respiratory and circulatory complications occur. Ideally, the patient should attempt to exhale while holding the mouth and nose closed as the wound is closed. This deflates the lungs and reduces the air trapped in the **pleural cavity**. Frequently, a taped, airtight dressing is all that is needed, but sometimes it is necessary to put in a stitch or two to make sure the wound is closed.

Eye Injuries

Eye injuries are quite serious in a survival situation due to pain and interference with other survival functions. The techniques for removing foreign bodies and for treating snow blindness are covered in standard first aid manuals. More serious eye injuries involving disruption of the contents of the orbit may require that the lids of the affected eye be taped closed or covered to prevent infection.

Thorns and Splinters

Thorns and splinters are frequently encountered in survival situations. Reduce their danger by wearing gloves and proper footgear. Their prompt removal is quite important to prevent infection. Wounds made by these agents are quite deep compared to their width which increases chances of infection by those organisms (such as tetanus) which grow best in the absence of oxygen. Removal of splinters is aided by the availability of a sharp instrument (needle or knife), needle nose pliers, or tweezers. Take care to get all of the foreign body out; sometimes it is best to open the wound enough to properly cleanse it and to allow air to enter the wound. When cleaned, treat as any other wound.

Environmental Injuries

Heat stroke, hypothermia, diarrhea, and intestinal parasites are environmental injuries you could face.

Heatstroke

The breakdown of the body's heat regulatory system (body temperature more than 40.5ºC [105ºF] causes a heatstroke. Other heat injuries, such as cramps or dehydration, do not always precede a heatstroke. Signs and symptoms of heatstroke are:

- Swollen, beet-red face.
- Reddened whites of eyes.
- Victim not sweating.
- Unconsciousness or delirium, which can cause an unnatural paleness or absence of color in the skin (pallor), a bluish color to lips and nail beds (cyanosis), and cool skin.

Note: *By this time the victim is in severe shock. Cool the victim as rapidly as possible. Cool him by dipping him in a cool stream. If one is not available, douse the victim with urine, water, or at the very least, apply cool wet compresses to all the joints, especially the neck, armpits, and crotch. Be sure to wet the victim's head. Heat loss through the scalp is great. Administer IVs and provide drinking fluids. You may fan the individual.*

Expect, during cooling:

- Vomiting.
- Diarrhea.
- Struggling.
- Shivering.
- Shouting.
- Prolonged unconsciousness.
- Rebound heatstroke within 48 hours.
- Cardic arrest; *be ready to perform CPR.*

Note: *Treat dehydration with lightly salted water.*

Hypothermia

Defined as the body's failure to maintain a temperature of 36ºC (97ºF). Exposure to cool or cold temperature over a short of long time can cause hypothermia. Dehydration and lack of food and rest condition the survivor to hypothermia.

Unlike heatstroke, you must gradually warm the hypothermia victim. Get the victim into dry clothing. Replace lost fluids, and warm him.

Diarrhea

A common, ailment caused by a change of water and food, drinking contaminated water, eating spoiled food, becoming fatigued, and using dirty dishes. You can avoid most of these causes by practicing preventive medicine. If you get diarrhea, however, and do not have antidiarrheal medicine, one of the following treatments may be effective:

- Limit your intake of fluids for 24 hours.
- Drink one cup of a strong tea solution every 2 hours until the diarrhea slows or stops. The tannic acid in the tea helps to control the diarrhea. Boil the inner bark of a hardwood tree for 2 hours or more to release the tannic acid.
- Make a solution of one handful of ground chalk, charcoal, or dried bones and treated water. If you have some apple pomace or the rinds of citrus fruit, add an equal

portion to the mixture to make it more effective. Take 2 tablespoons of the solution every 2 hours until the diarrhea slows or stops.

Intestinal Parasites

You can usually avoid infestations and other intestinal parasites if you take preventive measures. For example, never go barefoot. The most effective way to prevent intestinal parasites it to avoid uncooked meat and raw vegetables contaminated by raw sewage or human waste used as a fertilizer. However, should you become infested and lack proper medicine, you can use home remedies. Keep in mind that these home remedies work on the principle of changing the environment of the gastrointestinal tract. The following are home remedies you could use:

- *Salt water*. Dissolve 4 tablespoons of salt in 1 liter of water and drink. Do not repeat this treatment.

- *Tobacco*. Eat 1 to 1.5 cigarettes. The nicotine in the cigarette will kill or stun the worms long enough for your system to pass them. If the infestation is severe, repeat the treatment in 24 to 48 hours, *but no sooner*.

- *Kerosene*. Drink 2 tablespoons of kerosene *but no more*. If necessary, you can repeat this treatment in 24 to 48 hours. Be careful not to inhale the fumes. They may cause lung irritation.

- *Hot peppers*. Peppers are effective only if they are a steady part of your diet. You can eat them raw or put them in soups or rice and meat dishes. They create an environment that is prohibitive to parasitic attachment.

CHAPTER 2-2

Plants for Medicine

In a survival situation you will have to use what is available. In using plants and other natural remedies, positive identification of the plants involved is as critical as using them for food. Proper use of these plants is equally important.

Poultice: A heated, moist, or soft mass substance, as meal or clay, spread on cloth and applied to warm, moisten, or stimulate a sore or inflamed part of the body.

Decoction: To extract the flavor by boiling.

Terms and Definitions

The following terms, and their definitions, are associated with medicinal plant use:

- *Poultice*. The name given to crushed leaves or other plant parts, possibly heated, that you apply to a wound or sore either directly or wrapped in cloth or paper.
- *Infusion or tisane or tea*. The preparation of medicinal herbs for internal or external application. You place a small quantity of a herb in a container, pour hot water over it, and let it steep (covered or uncovered) before use.
- *Decoction*. The extract of a boiled down or simmered herb leaf or root. You add herb leaf or root to water. You bring them to a sustained boil or simmer to draw their chemicals into the water. The average ratio is about 28 to 56 grams (1 to 2 ounces) of herb to 0.5 liter of water.
- *Expressed juice*. Liquids or saps squeezed from plant material and either applied to the wound or made into another medicine.

Many natural remedies work slower than the medicines you know. Therefore, start with smaller doses and allow more time for them to take effect. Naturally, some will act more rapidly than others.

Specific Remedies

The following remedies are for use only in a survival situation, not for routine use:

- *Diarrhea*. Drink tea made from the roots of blackberries and their relatives to stop diarrhea. White oak bark and other barks containing tannin are also effective. However, use them with caution when nothing else is available because of possible negative effects on the kidneys. You can also stop diarrhea by eating white clay or campfire ashes. Tea made from cowberry or cranberry or hazel leaves works too.

- *Antihemorrhagics*. Make medications to stop bleeding from a **poultice** of the puffball mushroom, from plantain leaves, or most effectively from the leaves of the common yarrow or woundwort.

- *Antiseptics*. Use to cleanse wounds, sores, or rashes. You can make them from the expressed juice or chickweed leaves or the crushed leaves of dock. You can also make antiseptics from a **decoction** of burdock root, mallow leaves or roots, or white oak bark. All these medications are for external use only.

- *Fevers*. Treat a fever with a tea made from willow bark, an infusion of elder flowers or fruit, linden flower tea, or elm bark decoction.

- *Colds and sore throats*. Treat these illnesses with a decoction made from either plantain leaves or willow bark. You can also use a tea made from burdock

roots, mallow or mullein flowers or roots, or mint leaves.

- *Aches, pains, and sprains*. Treat with externally applied poultices of dock, plantain, chickweed, willow bark, garlic, or sorrel. You can also use salves made by mixing the expressed juices of these plants in animal fat or vegetable oils.

- *Itching*. Relieve the itch from insect bites, sunburn, or plant poisoning rashes by applying a poultice of jewelweed or witch hazel leaves. The jewelweed juice will help when applied to poison ivy rashes or insect stings. It works on sunburn as well as aloe vera.

- *Sedatives*. Get help in falling asleep by brewing a tea made from mint leaves or passionflower leaves.

- *Hemorrhoids*. Treat them with external washes from elm bark or oak bark tea, from the expressed juice of plantain leaves, or from a Solomon's seal root decoction.

- *Constipation*. Relieve constipation by drinking decoctions from dandelion leaves, rose hips, or walnut bark. Eating raw daylily flowers will also help.

- *Worms or intestinal parasites*. Using moderation, treat with tea made from tansy (Tanacetum vulgare) or from wild carrot leaves.

- *Gas and cramps*. Use a tea made from carrot seeds as an antiflatulent; use tea made from mint leaves to settle the stomach.

- *Antifungal washes*. Make a decoction of walnut leaves or oak bark or acorns to treat ringworm and athlete's foot. Apply frequently to the site, alternating with exposure to direct sunlight.

Miscellaneous Uses of Plants

- Make dyes from various plants to color clothing or to camouflage your skin. Usually, you will have to boil the plants to get the best results. Onion skins produce yellow, walnut hulls produce brown, and pokeberries provide a purple dye.

- Make fibers and cordage from plant fibers. Most commonly used are the stems from nettles and milkweeds, yucca plants, and the inner bark of trees like the linden.

- Make fish poison by dipping walnut hulls in a small area of water. This poison makes it impossible for the fish to breathe but doesn't adversely affect their edibility.

- Make tinder for starting fires from cattail fluff, cedar bark, lighter knot wood from pine trees, or hardened sap from resinous wood trees.

- Make insulation by fluffing up female cattail heads or milkweed down.

- Make insect repellents by applying the expressed juice of wild garlic or onion to the skin, by placing sassafras leaves in your shelter, or by burning or smudging cattail seed hair fibers.

Plants can be your ally as long as you use them cautiously. *The key to the safe use of plants is positive identification* whether you use them as food or medicine or in constructing shelters or equipment.

CHAPTER 2-3

Proper Body Temperature

Body Temperature

The body functions best when core temperatures range from 96ºF to l02ºF. Preventing too much heat loss or gain should be a primary concern for survivors. Factors causing changes in body core temperature (excluding illness) are the climatic conditions of temperature, wind, and moisture.

Temperature. As a general rule, exposure to extreme temperatures can result in considerable decreases in physical efficiency. In the worst case, incapacitation and death can result.

Wind. Wind increases the chill effect (fig. 2-11), and causes **dissipation** of heat, and accelerates loss of body moisture.

Moisture—Precipitation, Ground Moisture, or Immersion. Water provides an extremely effective way to transfer heat to and from the body. When a person is hot, the whole body may be soaked in a stream or other body of water to be cooled. On the other hand, in the winter, a hot bath can be used to warm the body. When water is around the body, it tends to bring the "body" to the temperature of the liquid. An example is when a hand is burned and then placed in cold water to reduce the heat. One way to lower body temperature is by applying water to clothing and exposing the clothed body to the wind. This action causes the heat to leave the body 25 times faster than when wearing dry clothing. This rapid heat transfer is the reason survivors must always guard against getting wet in cold environments. Consider the result of a body totally soaked in water at a temperature of 50ºF and determine how long a person could survive (figs. 2-12 and 2-13).

Dissipate: To lose (as heat or electricity) irrecoverably.

Heat Transfer

There are five ways body heat can be transferred. They are radiation, conduction, convection, evaporation, and respiration.

Radiation. Radiation is the primary cause of heat loss. It is defined as the transfer of heat waves from the body to the environment and (or) from the environment back to the body. For example, at a temperature of 50ºF, 50 percent of the body's total heat loss can occur through an exposed head and neck. As the temperature drops, the situation gets worse. At 5ºF, the loss can be 75 percent under the same circumstances. Not only can heat be lost from the head, but also from the other limbs of the body. The hands and feet radiate heat at a exceptional rate due to the large number of capillaries present at the surface of the skin. These three areas of the body must be given particular attention during all periods of exposure to temperature extremes.

Conduction. Conduction is defined as the movement of heat from one molecule to another molecule within a solid object. Extreme examples of how heat is lost and gained quickly are deep frostbite and third-degree burns, both gained from touching the same piece of metal at opposite extremes of cold and heat. Heat is also lost from the body in this manner by touching objects in the cold with bare hands, by sitting on a cold log, or by kneeling on snow to build a shelter.

These are practices which survivors should avoid since they can lead to overchilling the body.

Especially dangerous is the handling of liquid fuel at low temperatures. Unlike water which freezes at 32°F, fuel exposed to the outside temperatures will reach the same temperature as the air. The temperature of the fuel may be 10ºF to 30ºF below zero or colder. Spilling the fluid on exposed skin will cause instant frostbite, not only from the conduction of heat by the cold fluid, but by the further cooling effects of rapid evaporation of the liquid as it hits the skin.

Convection. Heat movement by means of air or wind to or from an object or body is known as convection. The human body is always warming a thin layer of air next to the skin by radiation and conduction. The temperature of this layer of air is nearly equal to that of the skin. The body stays warm when this layer of warm air remains close to the body. However, when this warm layer of air is removed by convection, the body cools down. A major function of clothing is to keep the warm layer of air close to the body; however, by removing or disturbing this warm air layer, wind can reduce body temperature. Therefore, wind can provide beneficial cooling in dry, hot conditions, or be a hazard in cold, wet conditions.

Evaporation. Evaporation is a process by which liquid changes into vapor, and during this process, heat within the liquid escapes to the environment. An example of this process is how a “desert water bag” works on the front of a jeep while driving in the hot desert. The wind created by the jeep helps to accelerate evaporation and causes the water in the bag to be cooled. The body also uses this method to regulate core temperature when it perspires and air circulates around the body. The evaporation method works any time the body perspires regardless of the climate. For this reason, it is essential that people wear fabrics that “breathe” in cold climates. If water vapor cannot evaporate through the clothing, it will condense, freeze, and reduce the insulation value of the clothing and cause the body temperature to go down.

Respiration. The respiration of air in the lungs is also a way of transferring heat. It works on the combined processes of convection, evaporation, and radiation. When breathing, the air inhaled is rarely the same temperature as the lungs. Consequently, heat is either inhaled or expelled with each breath. A person's breath can be seen in the cold as heat is lost to the outside. Because this method is so efficient at transferring heat, warm, moist oxygen is used to treat hypothermia patients in a clinical environment. Understanding how heat is transferred and the methods by which that transfer can be controlled can help survivors keep the body's core temperature in the 96ºF to l02ºF range. (fig. 2-14).

CHAPTER 2-4

Clothing

Everytime people go outside they probably neglect to think about one of the most important survival-oriented assets—clothing. Clothing is often taken for granted; people tend to neglect those things which should be the most familiar to them. Clothing is an important asset to survivors and is the most immediate form of shelter. Clothing is important in staying alive, especially if food, water, shelter, and fire are limited or unobtainable. This is especially true in the first stages of an emergency situation because survivors must work to satisfy other needs. If survivors are not properly clothed, they may not survive long enough to build a fire or shelter, to find food, or to be rescued.

Protection

People have worn clothing for protection since they first put on animal skins, feathers, or other coverings. In most parts of the world, people need clothing for protection from harsh climates. In snow or ice climates, people wear clothing made of fur, wool, or closely woven fabrics. They also wear warm footwear.

In dry climates, people wear clothing made of lightweight materials, such as cotton or linen, which have an open weave. These materials absorb perspiration and allow air to circulate around the body. People in dry climates sometimes wear white or light-colored clothes to reflect the sun's rays. They may also wear sandals, which are cooler and more comfortable than shoes. To protect the head and neck, people wear hats as sunshades.

Clothing also provides protection from physical injuries caused by vegetation, terrain features, and animal life which may cause bites, stings, and cuts.

Clothing Materials

Clothing is made from a variety of materials such as nylon, wool, cotton, synthetics, etc. The type of material used has a significant effect on protection. Potential survivors must be aware of both the environmental conditions and the effectiveness of these different materials in order to select the best type of clothing for a particular region.

Clothing materials include many natural and synthetic fibers. As material is woven together, a “dead air” space is created between the material fibers. When two or three layers of material are worn, a layer of air is trapped between each layer of material creating another layer of “dead air” or insulation. The ability of these different fibers to hold “dead air” is responsible for differing insulation values.

Natural Materials

Natural materials include fur, leather, and cloth made from plant and animal fibers.

Fur and leather are made into some of the warmest and most durable clothing. Fur is used mainly for coats and coat linings. Leather has to be treated to make it soft and flexible and to prevent it from rotting.

Wool is somewhat different because it contains natural lanolin oils. The long, red underwear of miners and settlers was made of wool, and for good reason. Wool is durable and water resistant, and even when soaked it can keep you warm.

Wool clothing is ideal in cold weather, and a wool shirt or sweater will ward off the chill of summer evenings, too. Wool makes excellent blankets, hiking socks, hats, and mittens. If wool irritates your skin, you may be able to wear wool blends or substitutes such as polypropylene.

Cotton is cool, comfortable, and sturdy, but unlike wool it will not keep you warm when it is wet. Of course, in hot weather that may be an advantage. Underwear and liner socks often are made of cotton, as are caps, shirts, and bandannas.

Cotton is a common plant fiber widely used to manufacture clothing. It absorbs moisture quickly and, with heat radiated from the body, will allow the moisture to pass away from the body. It does not offer much insulation when wet. It's used as an inner layer against the skin and as an outer layer with insulation (for example, wool, Dacron pile, synthetic batting) sandwiched between. The cotton protects the insulation and, therefore, provides warmth.

Synthetic Materials

Clothing manufacturers are using more and more of these materials. Many synthetic materials are stronger, more shrink-resistant, and less expensive than natural materials. Most synthetic fibers are derived from petroleum in the form of long fibers which consist of different lengths, diameters, and strengths, and sometimes have hollow cores. These fibers, woven into materials such as nylon, Dacron, and polyester, make very strong long-lasting clothing, tarps, tents, etc. Some fibers are spun into a batting type material with air space between the fibers, providing excellent insulation used inside clothing.

Synthetic fibers are generally lighter in weight than most natural materials and have much the same insulating qualities. They work well when partially wet and dry out easily; however, they generally do not compress as well as down.

Blends

Many fabrics are blends of natural and synthetic fibers. For example, fabrics could be a mixture of cotton and polyester or wool and nylon. For example, a blend of synthetics and cotton makes shirts and shorts that are neat in appearance, yet tough enough for any wilderness adventure. A mixture of synthetics and wool goes into long-wearing socks, shrink-resistant shirts, and warm jackets. Nylon covered with rubber is durable and waterproof but is also heavy. There are other coverings on nylon which are waterproof but somewhat lighter and less durable. However, most coated nylon has one drawback—it will not allow for the evaporation of perspiration. Therefore, individuals may have to change the design of the garment to permit adequate ventilation (for example, wearing the garment partially unzipped).

Layering System

For the most comfort in the outdoors use the layering system. Choose loose-fitting clothing that will meet the most extreme weather you expect to encounter, and be sure you can put it on and take it off a layer at a time. For example, on a chilly autumn day you might leave home wearing a long-sleeve shirt, long pants, a wool shirt, a sweater, mittens, and a stocking hat. As you walk, exercise will cause your body to generate more heat than it needs. Peel off the sweater and stuff it into your pack. If you’re still too warm, unbutton the wool shirt or slip off the mittens and hat.

When you reach your designation and are no longer exerting yourself, stay warm by reversing the procedure, pulling on just enough layers of clothing to stay comfortable. After the sun goes down, you may want to add an insulted parka and wool trousers or long underwear.

You can also use the layering system to keep cool in the summer by stripping down to shorts, a T-shirt, and a brimmed cap. Despite the heat, always carry long pants and a long-sleeve shirt for protection against sunburn, bugs, and brush.

Versatility in your clothing is the key to a successful layering system. Several shirts, a sweater, and a jacket will allow you to adjust your clothes in many more ways than will a single heavy coat.

Types of Insulation

Natural. Down is the soft plumage found between the skin and the contour feathers of birds. Ducks and geese are good sources for down. If used as insulation in clothing, remember that down will absorb moisture (either precipitation or perspiration) quite readily. Because of the light weight and compressibility of down, it has wide application in cold-weather clothing and equipment. It is one of the warmest natural materials available when kept clean and dry. It

provides excellent protection in cold environments; however, if the down gets wet it tends to get lumpy and loses its insulating value.

Cattail plants have a worldwide distribution, with the exception of the forested regions of the far north. The cattail is a marshland plant found along lakes, ponds, and the backwaters of rivers. The fuzz on the tops of the stalks forms dead-air spaces and makes a good down-like insulation when placed between two pieces of material.

Leaves from deciduous trees (those that lose their leaves each autumn) also make good insulation. To create dead-air space, leaves should be placed between two layers of material.

Grasses, mosses, and other natural materials can also be used as insulation when placed between two pieces of material.

Synthetic. Synthetic filaments such as polyesters and acrylics absorb very little water and dry quickly. Spun synthetic filament is lighter than an equal thickness of wool and unlike down does not collapse when wet. It is also an excellent replacement for down in clothing.

The nylon material in a parachute insulates well if used in the layer system because of the dead-air space. Survivors must use caution when using the parachute in cold climates. Nylon may become "cold soaked;" that is, the nylon will take on the temperature of the surrounding air. People have been known to receive frostbite when placing cold nylon against bare skin.

Insulation Measurement

The next area to be considered is how well these fibers insulate from the heat or cold. The most scientific way to consider the insulating value of these fibers is to use an established criterion. The commonly accepted measurement used is a comfort level of clothing, called a "CLo" factor.

The CLo factor is defined as the amount of insulation which maintains normal skin temperature when the outside ambient air temperature is 70ºF with a light breeze. However, the CLo factor alone is not sufficient to determine the amount of clothing required. Such variables as **metabolic** rate,

Metabolic: The complex of chemical and physical processes involved in the maintenance of life.

wind conditions, and the physical makeup of the individual must be considered.

The body's rate of burning or metabolizing food to produce heat varies among individuals. Therefore, some may need more insulation than others even though food intake is equal, and consequently the required CLo value must be increased. Physical activity also causes an increase in the metabolic rate and the rate of blood circulation through the body. When a person is physically active, less clothing or insulation is needed than when standing still or sitting. The effect of the wind, as shown on the wind-chill chart, must be considered (Chapter 2-3, fig. 2-11). When the combination of temperature and wind drops the chill factor to minus l00ºF or lower, the prescribed CLo for protecting the body may be inapplicable (over a long period of time) without relief from the wind. For example, when the temperature is minus 60ºF, the wind is blowing 60 to 70 miles per hour, and the resultant chill factor exceeds minus 150ºF, clothing alone is inadequate to sustain life. Shelter is essential.

The physical build of a person also affects the amount of heat and cold that can be endured. For example, a very thin person will not be able to endure as low a temperature as one who has a layer of fat below the skin. Conversely, heavy people will not be able to endure extreme heat as effectively as thinner people.

In the Air Force clothing inventory, there are many items which fulfill the need for insulating the body. They are made of the different fibers previously mentioned, and when worn in layers, provide varying degrees of insulative CLo value. The following average zone temperature chart is a guide in determining the best combination of clothing to wear.

Temperature Range	*CLo Required*
86 to 68ºF	1 - Lightweight
68 to 50ºF	2 - Intermediate Weight
50 to 32ºF	3 - Intermediate Weight
32 to 14ºF	3.5 - Heavyweight
14 to -4ºF	4.0 - Heavyweight
-4 to -40ºF	4.0 - Heavyweight

The amount of CLo value per layer of fabric is determined by the loft (distance between the inner and outer surfaces) and the amount of dead air held within the fabric. Some examples of the CLo factors and some items of clothing are:

Layers:	1—Aramid underwear (1 layer)	0.6	CLo
	2—Aramid underwear (2 layers)	1.5	CLo
	3—Quilted liners	1.9	CLo
	4—Nomex coveralls	.6	CLo
	5—Winter coveralls	1.2	CLo
	6—Nomex jacket	1.9	CLo

This total amount of insulation should keep the average person warm at a low temperature. When comparing items one and two in the above example, it shows when doubling the layer of underwear, the CLo value more than doubles. This is true not only on the number one item but between all layers of any clothing system. Therefore, one gains added protection by using several very thin layers of insulation rather than two thick layers. The air held between these thin layers increases the insulation value.

The use of many thin layers also provides (through removal of desired number of layers) the ability to closely regulate the amount of heat retained inside the clothing. The ability to regulate body temperature helps to alleviate the problem of overheating and sweating, and preserves the effectiveness of the insulation.

The principle of using many thin layers of clothing can also be applied to the "sleeping system" (sleeping bag, liner, and bed). This system uses many layers of synthetic material, one inside the other, to form the amount of dead air needed to keep warm. To improve this system, a survivor should wear clean and dry clothing in layers (the layer system) in cold climates. While discussing the layer system, it is important to define the “COLDER” principle. This acronym is used to aid in remembering how to use and take care of clothing.

C—Keep clothing **C**lean.
O—Avoid **O**verheating.
L—Wear clothing **L**oose and in **L**ayers.
D—Keep clothing **D**ry.
E—**E**xamine clothing for defects or wear.
R-Keep clothing **R**epaired.

Clean. Dirt and other materials inside fabrics will cause the insulation to be ineffective, wear down and cut the fibers which make up the fabric, and cause holes. Washing clothing in the field may be impractical; therefore, survivors should concentrate on using proper techniques to prevent soiling clothing.

Overheating. Clothing best serves the purpose of preserving body heat when worn in layers as follows: absorbent material next to the body, insulating layers, and outer garments to protect against wind and rain. Because of the rapid change in temperature, wind, and physical activity, garments should allow you to get into and get out of quickly and easily. Ventilation is essential when working because enclosing the body in an airtight layer system results in perspiration which wets clothing, thus reducing its insulating qualities.

Loose. Garments should be loose fitting to avoid reducing blood circulation and restricting body movement. Additionally, the garment should overhang the waist, wrists, ankles, and neck to reduce body heat loss.

Dry. Keep clothing dry since a small amount of moisture in the insulation fibers will cause heat losses up to 25 times faster than dry clothing. Internally produced moisture is as damaging as is externally dampened clothing. The outer layer should protect the inner layers from moisture as well as from abrasion of fibers; for example, wool rubbing on logs or rocks, etc. The outer shell keeps dirt and other contaminants out of the clothing. Clothing can be dried in many ways. Fires are often used; however, take care to avoid burning the items. The “bare hand” test is very effective. Place one hand near the fire in the approximate place the wet items will be and count to three slowly. If this can be done without feeling excessive heat, it should be safe to dry items there. Never leave any item unattended while it is drying. Leather boots, gloves, and mitten shells require extreme care to prevent shrinkage, stiffening, and cracking. The best way to dry boots is upright beside the fire (not upside down on sticks because the moisture does not escape the boot) or simply walk them dry in the milder climates.

The sun and wind can be used to dry clothing with little supervision except for checking occasionally on the incoming weather and making sure the article is secure. Freeze-drying is used in subzero temperatures with great success. Survivors let water freeze on or inside the item and then shake, bend, or beat it to cause the ice particles to fall free from the material. Tightly woven materials work better with this method than do open fibers.

Examine. All clothing items should be inspected regularly for signs of damage or soil.

Repair. Eskimos set an excellent example in the delicate care they provide for their clothing. When damage is detected, immediately repair it.

The neck, head, hands, armpits, groin, and feet lose more heat than other parts of the body and require greater protection. Work with infrared film shows tremendous heat loss in those areas when not properly clothed. Survivors in a cold environment are in a real emergency situation without proper clothing.

Rain Gear

No matter how clear the skies as you pack for a journey, prepare for nasty weather. That means always taking along a poncho or raincoat, a pack cover, and perhaps rain pants and gaiters. Choose rainwear that fits loosely enough to give you freedom of movement and to allow perspiration to evaporate without condensing on the inside of the fabric.

Ponchos provide wet-weather security for both survivors and their gear. In emergencies, ponchos can serve as temporary shelters. They can, however, blow around in a strong wind, and thus may not give full protection in severe storms.

Backpacker rainsuits are almost invincible. Many feature hoods and large cargo pockets. Rainpants and rain chaps will protect your legs from wind, rain, and heavy dew, while gaiters will keep pebbles, water, mud, and snow out of your boots and away from you socks.

Although most packs can repel rain for a time, make sure your gear stays dry by taking along a pack cover. You can make a simple one by cutting a slit in a plastic garbage bag and tucking the loose ends around your pack frame, or you can buy or sew a cover especially contoured to fit your pack.

Clothing Wear in Snow and Ice Areas

The survivor should:

- Avoid restricting the circulation. Clothing should not be worn so tight that it restricts the flow of blood which distributes the body heat and helps prevent frostbite. When wearing more than one pair of socks or gloves, ensure that each succeeding pair is large enough to fit comfortably over the other. Don't wear three or four pairs of socks in a shoe fitted for only one or two pairs. Release any restriction caused by twisted clothing or a tight parachute harness.
- Keep the head and ears covered. Survivors will lose as much as 50 percent of their total body heat from an unprotected head at 50ºF.
- When exerting the body, prevent perspiration by opening clothing at the neck and wrists and loosening it at the waist. If the body is still warm, comfort can be obtained by taking off outer layers of clothing, one layer at a time. When work stops, the individual should put the clothing on again to prevent chilling.
- If boots are big enough, use dry grass, moss, or other material for added insulation around the feet. Footgear can be improvised by wrapping parachute cloth or other fabric lined with dry grass or moss for insulation.

Felt booties and mukluks with the proper socks and insoles are best for dry, cold weather. Rubber-bottomed boot shoepacs with leather tops are best for wet weather. Mukluks should not be worn in wet weather. The vapor-barrier rubber boots can be worn under both conditions and are best at extremely low temperatures. The air release valve should be closed at ground level. These valves are designed to release pressure when airborne. Air should not be blown into the valves as the moisture could decrease insulation.

Clothing should be kept as dry as possible. Snow must be brushed from clothing before entering a shelter or going near a fire. The survivors should beat the frost out of garments before warming them and dry them on a rack near a fire. Socks should be dried thoroughly.

One or two pairs of wool gloves and/or mittens should be worn inside a waterproof shell (fig. 2-15). If survivors have to expose their hands, they should warm them inside their clothing.

To help prevent sun or snow blindness, a survivor should wear sun or snow goggles or improvise a shield with a small horizontal slit opening (fig. 2-16).

In strong wind or extreme cold, as a last resort, a survivor should wrap up in parachute material, if available, and get into some type of shelter or behind a windbreak. Extreme care should be taken with hard materials, such as synthetics, as they may become cold soaked and require more time to warm.

At night, survivors should arrange dry spare clothing loosely around and under the shoulders and hips to help keep the body warm. Wet clothes should never be worn into the sleeping bag. The moisture destroys the insulation value of the bag.

If survivors fall into water, they should roll in dry snow to blot up moisture, brush off the snow, and roll again until most of the water is absorbed. They should not remove footwear until they are in a shelter or beside a fire.

All clothing made of wool offers good protection when used as an inner layer. When wool is used next to the face and neck, survivors should be cautioned that moisture from the breath will condense on the surface and cause the insulating value to decrease. The use of a wool scarf wrapped around the mouth and nose is an excellent way to prevent cold injury, but it needs to be de-iced on a regular basis to prevent freezing flesh adjacent to it. An extra shell is generally worn over the warming layers to protect them and to act as a windbreak.

Other headgear includes the pile cap and hood. These items are most effective when used with a covering for the face in extreme cold. The pile cap is extremely warm where it is insulated, but it offers little protection for the face and back of the neck.

The hood is designed to funnel the radiant heat rising from the rest of the body and to recycle it to keep the neck, head, and face warm. (fig. 2-17). The individual's ability to tolerate cold should dictate the size of the front opening of the hood. The "tunnel" of a parka hood is usually lined with fur of some kind to act as a protecting device for the face. This same fur also helps to protect the hood from the moisture expelled during breathing. The closed tunnel holds heat close to the face longer; the open one allows the heat to escape more freely. As the frost settles on the hair of the fur, it should be shaken from time to time to keep it free of ice buildup.

Sleeping systems (sleeping bag, liner, and bed) are the transition "clothing" used between normal daytime activities and sleep (fig. 2-18).

The insulating material in the sleeping bag may be synthetic or it may be down and feathers. (Feathers and down lining require extra protection from moisture). However, the covering is nylon. Survivors must realize that sleeping bags are compressed when packed and must be fluffed before use to restore insulation value. Clean and dry socks, mittens, and other clothing can be used to provide additional insulation.

Footwear

Footgear is critical in a survival situation because walking is the only means of mobility. Therefore, care of footgear is essential both before and during a survival situation. Recommendations for care are:

- Ensure footgear is properly "broken-in"
- before wearing.
- "Treat" footgear to ensure water-repellence (follow manufacturer's recommendations).
- Keep leather boots as dry as possible.

Mukluks have been around for thousands of years and have proven their worth in extremely cold weather. The Air Force mukluks are made of cotton duck with rubber-cleated soles and heels (fig. 2-19). They have slide fasteners from instep to collar, laces at instep and collar, and are 18 inches high. They are used by flying and ground personnel

operating under *dry,* cold conditions in temperatures below + 15ºF Survivors should change liners daily when possible.

Leather Boots

When you're hiking, your feet and ankles take a tremendous pounding. Quality hiking boots will give them the support and protection they need to withstand the jarring of each step. The best leather boots are made of top-grain leather, which breathes, allowing moisture from your feet to escape. A minimum of seams keeps wetness from penetrating. Lug soles provide the most traction, though smoother soles are usually adequate, frequently lighter, and often less damaging to trails. Since a pound of weight on your feet is equal to 5 pounds on your back, stick with boots that weigh no more than 3 to 5 pounds a pair for trail wear. Mountaineering boots are heavier and more rigid, and appropriate only for the specialized needs of climbers.

Selecting Footwear

When you go into a store to try on boots, wear the socks in which you plan to wear on your journey. Unlace a boot, slip in your foot, and kick your toes forward. If the boot is the right length, you should be able to slide two fingers between your heel and the back of the boot.

Next, kick your heel back into the heel pocket, and with the boot snugly laced, walk around the shop, go up and down some stairs, and do a few deep knee bends. You want to be sure your heel isn't sliding up and down inside the boot, and that the widest part of your foot isn't swimming around or being squeezed. After you've tried out one pair, run the same tests on several other models, taking plenty of time to get a real feel for the fit. Inspect each boot for quality workmanship. Before you buy, make sure the store will allow you to bring the boots back, undamaged, if they don't fit. That way you can take them home and wear them for several days inside the house. If they still feel good, you've probably got a pair that's right for you.

Breaking in Leather Boots

Like new baseball gloves, new leather boots usually are stiff. They must be broken in before you wear them on an extended journey or you're in for a lot of blisters.

First, treat your boots with the dressing recommended by the manufacturer. Rub it thoroughly into the leather with a rag or your hand. This will protect the boots and help them repel water. You may also want to guard the boot seams against moisture and abrasion by applying a commercial seam sealer.

Wear the boots around the house and on short walks until they have loosened. Gradually extend the length of the walks on which you wear them, and soon they'll feel like a natural part of your feet.

Caring for Boots

No matter what kind of boots you have, clean them after every outing. When boots are muddy, use a stiff brush to remove the mud, then apply more dressing to the leather. If they become wet, dry them at room temperature. Never expose them to more heat than you can tolerate on the back of your hand. Synthetics may melt, and leather can become hardened and cracked. Take care of your boots and they'll give you years of good service.

Making Your Own Footwear

Moose Hock Shoe. The hock skin of a moose or caribou will provide a suitable pair of shoes (fig. 2-20). Cut skin around leg at A and B. Separate from the leg and pull it over the hoof. Shape and sew up small end C. Slit skin from A to B; bore holes on each side of cut for lacing; turn inside out, and lace with rawhide, suspension line, or other suitable material.

Grass Insoles. Used extensively by northern natives to construct inner soles. Grass is a good insulator and will collect moisture from the feet. The survivor should use the following procedure to prepare grass for use as inner soles: Grasp a sheaf of tall grass, about one-half inch in diameter, with both hands. Rotate the hands in opposite directions.

The grass will break up or "fluff" into a soft mass. Form this fluff into oblong shapes and spread it evenly throughout the shoes. The inner soles should be about an inch thick. Remove these inner soles at night and make new ones the following day.

Hudson Bay Duffel. A triangular piece of material used as a foot covering. To improvise this foot covering, a survivor can use the following procedures:

1. Cut two to four layers of parachute cloth into a 30-inch square.
2. Fold this square to form a triangle.
3. Place the foot on this triangle with the toes pointing at one corner.
4. Fold the front cover up over the toes.
5. Fold the side corners, one at a time, over the instep. This completes the foot wrap. (fig. 2-21).

Gaiters. Made from parachute cloth, webbing, or canvas. Gaiters help keep sand and snow out of shoes and protect the legs from bites and scratches (fig. 2-22).

Double Socks. Cushion padding, feathers, dry grass, or fur stuffed between layers of socks. Wrap parachute or aircraft fabric around the feet and tie above the ankles. A combination of two or more types of improvised footwear may be more desirable and more efficient than any single type (fig. 2-23).

Clothing in the Summer Arctic

In the summer arctic, there are clouds of mosquitoes and black flies so thick a person can scarcely see through them. Survivors can protect themselves by wearing proper clothing to ensure no bare skin is exposed. A good head net and gloves should be worn.

Head nets must stand out from the face so they won't touch the skin. Issued head nets are either black or green. If one needs to be improvised they can be sewn to the brim of the hat or can be attached with an elastic band that fits around the crown. Black is the best color, as it can be seen through more easily than green or white. A heavy tape encasing a drawstring should be attached to the bottom of the head net for tying snugly at the collar. Hoops of wire fastened on the inside will make the net stand out from the face and at the same time allow it to be packed flat. The larger they are, the better the ventilation. But very large nets will not be as effective in wooded country where they may become snagged on brush.

Gloves are hot, but are a necessity where flies are found in swamps. Kid gloves with a 6-inch gauntlet closing the gap at the wrist and ending with an elastic band halfway to the elbow are best. For fine work, kid gloves with the fingers cut off are good. Cotton/Nomex work gloves are better than no protection at all, but mosquitoes will bite through them. Treating the gloves with insect repellent will help. Smoky clothing may also help to keep insects away (fig. 2-24).

A survivor should remember that mosquitoes do not often bite through two layers of cloth; therefore, a lightweight undershirt and long underwear will help. To protect ankles, blouse the bottoms of trousers around boots, or wear some type of leggings (gaiters).

If the head net is lost or none is available, make the best of a bad situation by wearing sunglasses with improvised screened sides, plugging ears lightly with cotton, and tying a handkerchief around the neck. Treat clothing with insect repellent at night.

Warm-Weather Clothing List	**Cold-Weather Clothing List**
___Long-sleeve shirt	___Long-sleeve shirt
___T-shirts	___Wool Shirt
___Long pants	___Long pants(wool military surplus pants are fine)
___Hiking shorts	___Wool sweater
___Sweater or warm jacket	___Long underwear preferable polyester or polypropylene)
___Underwear	___Socks (preferably wool)
___Socks	___Insulated parka or coat with hood
___Moccasins or running shoes (for wear around camp)	___Wool stocking cap
___Visored cap	___Mittens
___Bandanas	___Insulated booties or mukluks
___Rain gear	___Bandanas

Clothing at Sea

In cold oceans, survivors must try to stay dry and keep warm. If wet, they should use a wind screen to decrease the cooling effects of the wind. They should also remove, wring out, and replace outer garments or change into dry clothing. Hats, socks, and gloves should also be dried. If any survivors are dry, they should share extra clothes with those who are wet. Wet personnel should be given the most sheltered positions in the raft. Let them warm their hands and feet against those who are dry. Survivors should put on any extra clothing available. If no antiexposure suits are provided, they can drape extra clothing around their shoulders and over their heads. Clothes should be loose and comfortable. Also, survivors should attempt to keep the floor of the raft dry. For insulation, covering the floor with any available material will help. Survivors should huddle together on the floor of the raft and spread extra **tarpaulin**, sail, or parachute material over the group. If in a 20- or 25-man raft, canopy sides can be lowered. Performing mild exercises to restore circulation may be helpful. Survivors should exercise fingers, toes, shoulders, and buttock muscles. Mild exercise will help keep the body warm, stave off muscle spasms, and possibly prevent medical problems. Survivors should warm hands under armpits and periodically raise feet slightly and hold them up for a minute or two. They should also move face muscles frequently to prevent frostbite. Shivering is the body's way of quickly generating heat and is considered normal. However, persistent shivering may lead to uncontrollable muscle spasms. They can be avoided by exercising muscles. If water is available, additional rations should be given to those suffering from exposure to cold. Survivors should eat small amounts frequently rather than one large meal.

Antiexposure Garments

Assemblies. The antiexposure assemblies, both quick donning and constant wear, are designed for personnel participating in over-water flights where unprotected or prolonged exposure to the climatic conditions of cold air and/or cold water (as a result of ditching or abandoning an aircraft) would be dangerous or could prove fatal. The suit provides protection from the wind and insulation against the chill of the ocean. The result of exposure in the water is illustrated in figures 2-12 and 2-13. Exposure time varies depending on the particular antiexposure assembly worn, the cold sensitiveness of the person, and survival procedures used.

Quick-Donning Antiexposure Flying Coverall. Some antiexposure coveralls are designed for quick donning (approximately 1 minute) before emergency ditching. After ditching the aircraft, the coverall protects the wearer from exposure while swimming in cold water, and from exposure to wind, spray, and rain when adrift in a liferaft.

The coverall is a one-size garment made from chloroprene-coated nylon cloth. It has two expandable-type patch pockets, an adjustable waist belt, and attached boots with adjustable ankle straps. One pair of insulated, adjustable wrist strap mittens, each with a strap attached to a pocket, is provided. A hood, also attached with a strap, is in the left pocket. A carrying case with instructions and a snap fastener closure is furnished for stowing in the aircraft.

To use the coverall, personnel should wear it over regular clothing. It is large enough to wear over the usual flight gear. The gloves and hood are stowed in the pockets of the coverall and are normally worn after boarding the liferaft.

The survivor should be extremely careful when donning the coverall to prevent damage by snagging, tearing, or puncturing it on projecting objects. After donning the coverall, the waist band and boot ankle straps should be adjusted to take up fullness. If possible, survivors should stoop while pulling the neck seal to expel air trapped in the suit. When jumping into the water, they should leap feet first with hands and arms close to sides or brought together above the head (fig. 2-25). Note there is a constant wear exposure suit designed to be worn continuously during overwater flights where the water temperature is 60º or below.

Warm Oceans

Protecting against the Sun and securing drinking water are the most important problems. A survivor should keep the body covered as much as possible to avoid sunburn. A sunshade can be improvised out of any materials available or the canopy provided with the raft may be used. If the heat becomes too intense, survivors may dampen clothing with sea water to promote evaporation and cooling. The use of sunburn preventive cream or a Chapstick is advisable. Remember, the body must be kept covered completely. Exposure to the Sun increases thirst, wastes precious water, reduces the body's water content, and causes serious burns. Survivors should roll down their sleeves, pull up their socks, close their collars, wear a hat or improvised headgear, use a piece of cloth as a shield for the back of the neck, and wear sunglasses or improvise eye covers.

Tropical Climates

In tropical areas, the body should be kept covered for prevention of insect bites, scratches, and sunburn.

When moving through vegetation, survivors should roll down their sleeves, wear gloves, and blouse the legs of their pants or tie them over their boot tops. Improvised puttees (gaiters) can be made from parachute material or any available fabric. This will protect legs from ticks and leeches.

Loosely worn clothing will keep survivors cooler, especially when subjected to the direct rays of the Sun.

Survivors should wear a head net or tie material around the head for protection against insects. The most active time for insects is at dawn and dusk. An insect repellent should be used at these times.

In open country or in high grass, survivors should wear a neck cloth or improvised head covering for protection from sunburn and/or dust. They should also move carefully through tall grass, as some sharp-edged grasses can cut clothing to shreds. Survivors should dry clothing before nightfall. If an extra change of clothing is available, effort should be made to keep it clean and dry.

Dry Climates

In the dry climates of the world, clothing will be needed for protection against sunburn, heat, sand, and insects. Survivors should not discard any clothing. They should keep their head and body covered and blouse the legs of pants over the tops of footwear during the day. Survivors should not roll up sleeves, but keep them rolled down and loose at the cuff to stay cool.

Survivors should keep in mind that the people who live in the hot dry areas of the world usually wear heavy white flowing robes which protect almost every inch of their bodies. The only areas open to the Sun are the face and the eyes. This produces an area of higher humidity between the body and the clothing, which helps keep them cooler and conserves their perspiration (fig. 2-26). The white clothing also reflects the sunlight.

Survivors should wear a cloth neckpiece to cover the back of the neck and protect it from the Sun. A T-shirt makes an excellent neck drape, with the extra material used as padding under the cap. If hats are not available, survivors can make headpieces like those worn by the Arabs, as shown in figure 2-26. During dust storms, they should wear a covering for the mouth and nose; parachute cloth will work.

If shoes are lost or if they wear out, survivors can improvise footgear. One example of this is the “Russian Sock.” Parachute material can be used to improvise these socks. The parachute material is cut into strips approximately 2 feet long and 4 inches wide. These strips are wrapped bandage fashion around the feet and ankles. Socks made in this fashion will provide comfort and protection for the feet.

CHAPTER 2-5

Shelters

A **shelter** can protect your from the Sun, insects, wind, rain, snow, and hot or cold temperatures. It can give you a feeling of well-being. It can help you maintain your will to survive.

In some areas, your need for shelter may take priority over your need for food and possibly even your need for water. For example, prolonged exposure to cold can cause excessive fatigue and weakness (exhaustion). An exhausted person may develop a "passive" outlook, thereby losing the will to survive.

The most common error in making a shelter is to make it too large. A shelter must be large enough to protect you. It must also be small enough to contain your body heat especially in cold climates.

The information in this chapter describes how the environment influences shelter site selection and factors which survivors must consider before constructing an adequate shelter. The techniques and procedures for constructing shelters for various types of protection are also presented.

Shelter: Is anything that protects a survivor from the environmental hazards.

Shelter Considerations

The location and type of shelter built by survivors vary with each survival situation. There are many things to consider when picking a site. Survivors should consider the time and energy required to establish an adequate camp, weather conditions, life forms (human, plant, and animal), terrain, and time of day. Every effort should be made to use as little energy as possible and yet attain maximum protection from the environment.

Time

Late afternoon is not the best time to look for a site which will meet the day's shelter requirements. If survivors wait until the last minute, they may be forced to use poor materials in unfavorable conditions. They must constantly be thinking of ways to satisfy their needs for protection from environmental hazards.

Weather

Weather conditions are a key consideration when selecting a shelter site. Failure to consider the weather could have disastrous results. Some major weather factors which can influence the survivor's choice of shelter type and site selection are temperature, wind, and precipitation.

Temperature. Temperatures can vary considerably within a given area. Setting up a campsite in low areas such as a valley in cold regions can expose survivors to low night temperatures and wind-chill factors. Colder temperatures are found along valley floors which are sometimes referred to as "cold air sumps." It may be advantageous to set up campsites to take advantage of the Sun. Survivors could place their shelters in open areas during the colder months for added warmth and in shaded areas for protection from the Sun during periods of hotter weather. In some areas a compromise may have to be made. For example, in many deserts the daytime temperatures can be very high while low temperatures at night can turn water to ice. Protection from both heat and cold are needed in these areas. Shelter type and location should be chosen to provide protection from the existing temperature conditions.

Wind. Wind can be either an advantage or a disadvantage depending upon the temperature of the area and the velocity of the wind. During the summer or on warm days,

survivors can take advantage of the cool breezes and protection the wind provides from insects by locating their camps on knolls or spots of land. Conversely, wind can become an annoyance or even a hazard as blowing sand, dust, or snow can cause skin and eye irritation and damage to clothing and equipment. On cold days or during winter months, survivors should seek shelter sites which are protected from the effects of wind-chill and drifting snow.

Precipitation. The many forms of precipitation (rain, sleet, hail, or snow) can also present problems for survivors. Shelter sites should be out of major drainages and other low areas to provide protection from flash floods or mud slides resulting from heavy rains. Snow can also be a great danger if shelters are placed in potential avalanche areas.

Life Forms

All life forms (plant and animal) must be considered when selecting the campsite and the type of shelter that will be used. For a shelter to be adequate, certain factors must be considered, especially if extended survival is expected.

Insect life can cause personal discomfort, disease, and injury. By locating shelters on knolls, ridges, or any other area that has a breeze or steady wind, survivors can reduce the number of flying insects in their area. Staying away from standing water sources will help to avoid mosquitoes, bees, wasps, and hornets. Ants can be a major problem; some species will forcefully defend their territories with painful stings or bites, or release particularly unpleasant odors.

Large and small animals can also be a problem, especially if the camp is set up near their trails or waterholes.

Dead trees that are standing, and trees with dead branches should be avoided. Wind may cause them to fall, causing injuries or death. Poisonous plants, such as poison oak or poison ivy, must also be avoided when locating a shelter.

Terrain

Scree and Talus: An accumulation of loose stones or rocky debris lying on a slope or at the back of a hill or cliff.

Terrain hazards may not be as apparent as weather and animal life hazards, but they can be many times more dangerous. Avalanche, rock, dry streambeds, or mud-slide areas should be avoided. These areas can be recognized by either a clear path or a path of secondary vegetation, such as 1- to 15-foot tall vegetation or other new growth which extends from the top to the bottom of a hill or mountain. Survivors should not choose shelter sites at the bottom of steep slopes which may be prone to slides. Likewise, there is a danger in camping at the bottom of steep **scree** or **talus** slopes. Additionally, rock overhang must be checked for safety before using it as a shelter.

Location

When you are in a survival situation and realize that shelter is a high priority, start looking for shelter as soon as possible. As you do so, remember what you will need at the site. Four requisites are:

1. It must be near water, food, fuel, and a signal or recovery site.

2. The area must be safe, providing natural protection from environmental hazards.

3. Materials must be available to construct the shelter.

In some cases, the “shelter” may already be present. Survivors seriously limit themselves if they assume shelters *must* be a constructed framework having predetermined dimensions and a cover of parachute material or a signal paulin. More appropriately, survivors should consider using sheltered *places* already in existence in the immediate area. This does not rule out shelters with a constructed framework and parachute or other manufactured material covering; it simply enlarges the scope of what can be used as a survival shelter.

4. The area chosen must be both large enough and level enough for the survivor to lie down.

Personal comfort is an important fundamental for survivors to consider. A satisfactory shelter provides physical and mental well-being for sound rest. Plenty of rest is very important if survivors are to make sound decisions. Their need for rest becomes more critical as time passes and rescue or return is delayed. Before actually constructing a shelter, survivors must determine the specific purpose of the shelter. The following factors influence the type of shelter to be built.

- Rain or other precipitation.
- Cold.
- Heat.
- Insects.
- Available materials nearby (manufactured or natural).
- Length of expected stay.
- Number and physical condition of survivors.

If possible, survivors should try to find a shelter which needs little work to be adequate. Using what is already there, so that complete construction of a shelter is not necessary, saves time and energy. For example, rock overhangs, caves, large cracks, fallen logs, root supports, or snow banks can all be modified to provide satisfactory shelter. Modifications may include adding snow blocks to finish off an existing tree well shelter, increasing the insulation of the shelter by using vegetation or parachute material, or building a reflector fire in front of a rock overhang or cave. Survivors must consider the amount of energy required to build the shelter. It is not really wise to spend a great deal of time and energy in constructing a shelter if nature has provided a natural shelter nearby which will satisfy the survivor's needs. See figure 2-27 for an example of naturally occurring shelter.

The size limitations of a shelter are important only if there is either a lack of material on hand or if it is cold. Otherwise, the shelter should be large enough to be comfortable yet not so large as to cause an excessive amount of work. Any shelter, naturally occurring or otherwise, in which a fire is to be built must have a ventilation system which will provide fresh air and allow smoke and carbon monoxide to escape. Even if a fire does not produce visible smoke (such as heat tabs), the shelter must still be vented. If a fire is to be placed outside the shelter, the opening of the shelter should be placed 90 degrees to the prevailing wind. This will reduce the chances of sparks and smoke being blown into the shelter if the wind should reverse direction in the morning and evening. This frequently occurs in mountainous areas. The best fire to shelter distance is approximately 3 feet. If an aircrew member's situation, one place where it *would not* be wise to build a fire is near the aircraft wreckage, especially if it is being used as a shelter. The possibility of igniting spilled lubricants or fuels is great. Survivors may decide instead to use materials from the aircraft to add to a shelter located a safe distance from the crash site.

Types of Shelters

When looking for a shelter site, keep in mind the type of shelter (protection) you need. However, you must also consider:

- How much time and effort you need to build the shelter.
- If the shelter will adequately protect you from the elements (Sun, wind, rain, snow).
- If you have the tools to build it. If not, can you make improvised tools?
- If you have the type and amount of materials needed to build it.

To answer these questions, you need to know how to make various types of shelters and what materials you need to make them.

Immediate Action Shelters

The first type of shelter that survivors may consider using, or the first type they may be forced to use, is an immediate action shelter. An immediate action shelter is one which can be erected quickly with minimum effort; for

example, raft, aircraft parts, parachutes, paulin, and plastic bag. Natural formations can also shield survivors from the elements immediately, to include overhanging ledges, fallen logs, caves, and tree wells (fig. 2-28). It isn't necessary to be concerned with exact shelter dimensions. Survivors should remember that if shelter is needed, use an existing shelter if at all possible. They should improvise on natural shelters or construct new shelters only if necessary. Regardless of type, the shelter must provide whatever protection is needed and, with a little ingenuity, it should be possible for survivors to protect themselves and do so quickly. In many instances, the immediate action shelters may have to serve as permanent shelters for survivors. For example, many aircrew members fly without parachutes, large cutting implements (axes), and entrenching tools; therefore, multiperson liferafts may be the only immediate or long-term shelter available. In this situation, multiperson liferafts must be deployed in the quickest manner possible to ensure maximum advantages are attained from the following shelter principles:

- Set up in areas which afford maximum protection from precipitation and wind and use the basic shelter principle in topics discussed in the Shelter Considerations and Location.
- Anchor the raft for retention during high winds.
- Use additional boughs, grasses, etc., for ground insulation.

Improvised Shelters

Shelters of this type should be easy to construct and/or dismantle in a short period of time. However, these shelters usually require more time to construct than an immediate action shelter. For this reason, survivors should only consider this type of shelter when they aren't immediately concerned with getting out of the elements. Shelters of this type include the following:

- The “A frame” design is adaptable to all environments as it can be easily modified; for example, tropical para-hammock, temperate area “A frame,” arctic thermal “A frame,” and fighter trench.
- Simple shade shelter; these are useful in dry areas.
- Various paratepees.
- Snow shelters; includes tree-pit shelters.
- All other variations of the above shelter types; sod shelters, etc.

Shelters for Warm Temperature Areas

The first step is deciding the type of shelter required. No matter which shelter is selected, the building or improvising process should be planned and orderly, following proven procedures and techniques. The second step is to select, collect, and prepare all materials needed before the actual construction; this includes framework, covering, bedding, or insulation, and implements used to secure the shelter (“dead-men,” lines, stakes, etc.).

For shelters that use a wooden framework, the poles or wood selected should have all the rough edges and stubs removed. Not only will this reduce the chances of the parachute fabric being ripped, but it will eliminate the chances of injury to survivors.

On the outer side of a tree selected as natural shelter, some or all of the branches may be left in place as they will make a good support structure for the rest of the shelter parts.

In addition to the parachute, there are other materials which can be used as framework coverings. Some of the following are both framework and covering all in one:

- Bark peeled off dead trees.
- Boughs cut off trees.
- Bamboo, palm, grasses, and other vegetation cut or woven into desired patterns.

The next step in the process of shelter construction is site preparation. This includes brushing away rocks and twigs from the sleeping area and cutting back overhanging vegetation.

The fourth step is to actually construct the shelter, beginning with the framework. The framework is very important. It must be strong enough to support the weight of the covering

and possible buildup of snow. It must also be sturdy enough to resist strong wind gusts.

Construct the framework in one of two ways. For natural shelters, branches may be securely placed against trees or other natural objects. For parachute shelters, poles may be lashed to trees or to other poles. The support poles or branches can then by laid and/or attached depending on their function.

The pitch of the shelter is determined by the framework. A 60-degree pitch is best for shedding **precipitation** and providing shelter room.

The size of the shelter is determined by the framework. The shelter should be large enough for survivors to sit up, with plenty of room to lie down and to store all personal equipment.

After the basic framework has been completed, survivors can apply and secure the framework covering. The care and techniques used to apply the covering will determine the effectiveness of the shelter in shedding precipitation.

If survivors are to use parachute material, they should remember that “pitch and tightness" apply to shelters designed to shed rain or snow. Parachute material is absorbent and will not shed moisture unless it is stretched tightly at an angle of sufficient pitch which will encourage run-off instead of penetration. An angle of 40 to 60 degrees is recommended for the “pitch” of the shelter. The material stretched over the framework should be wrinkle-free and tight. Survivors should not touch the material when water is running over it as this will break the surface tension at that point and allow water to drip into the shelter. Two layers of parachute material, 4 to 6 inches apart, will create a more effective water repellent covering. Even during hard rain, the outer layer only lets a mist come through if it is pulled tight. The inner layer will then channel off any moisture which may come through. This layering of parachute material also creates a dead-air space that covers the shelter. This is especially beneficial in cold areas when the shelter is enclosed. Plenty of insulation can also be provided by branches, aircraft parts, snow, etc. These will be discussed in more depth in the area of cold climate shelters. A double layering of parachute material helps to trap body heat, radiating heat from the Earth's surface, and other heating sources.

Precipitation: A deposition on the Earth of hail, mist, rain, sleet, or snow.

If parachute material is to be used alone or in combination with natural materials, it must be changed slightly. Survivors should remove all of the lines from the parachute and then cut it to size. This will eliminate bunching and wrinkling and reduce leakage.

If natural materials are to be used for the covering, the shingle method should be used. Starting at the bottom and working toward the top of the shelter, the bottom of each piece should overlap the top of the preceding piece. This will allow water to drain off. The material should be placed on the shelter in ample quantity so that survivors in the shelter cannot see through it.

Maintenance and Improvements

Once a shelter is constructed, it must be maintained. Additional modifications may make the shelter more effective and comfortable. Indian lacing (lacing the front of the shelter to the bipod) will tighten the shelter. A door may help block the wind and keep insects out. Other modifications may include a fire reflector, porch or work area, or another whole addition such as an opposing lean-to.

Construction of Specific Shelters

A-Frame

The following is one way to build an A-frame shelter in a warm or temperate environment using parachute material or fabric for the covering. There are as many variations of this shelter as there are builders. The procedures here will, if followed carefully, result in the completion of a safe shelter that will meet survivors' needs. For an example of this and other A-frame shelters, see figure 2-29.

Materials:

- One 12- to 18-foot long sturdy ridge pole with all projections cleaned off.
- Two bipod poles, approximately **7** feet long.
- Parachute material or fabric.
- Suspension lines.
- "Buttons," small objects placed behind gathers of material to provide a secure way of affixing suspension line to the parachute material.
- Approximately 14 stakes, approximately 10 inches long.

Assembling the Framework:

- Lash the two bipod poles together at eye-level height.
- Place the ridge pole, with the large end on the ground, into the bipod formed by the poles and secure with a square lash.
- The bipod structure should be 90 degrees to the ridge pole and the bipod poles should be spread out to an approximate equilateral triangle of a 60-degree pitch. A piece of line can be used to measure this.

Applying the Fabric:

- Tie off about 2 feet of the apex in a knot and tuck this under the butt end of the ridge pole. Use half hitches and clove hitches to secure the material to the base of the pole.
- Place the center radial seam of the parachute piece (or the center of the fabric) on the ridge pole. After pulling the material tight, use half hitches and clove hitches to secure the fabric to the front of the ridge pole.
- Draw a line on the ground from the butt of the ridge pole to each of the bipod poles. Stake the fabric down, starting at the rear of the shelter and alternately staking from side to side to the shelter front. Use plenty of stakes to ensure the parachute material is wrinkle-free.
- Stakes should be slanted away from the direction of pull. When tying off with a clove hitch, the line should pass in front of the stake first and then pass under itself to allow the button and line to be pulled 90 degrees to the wrinkle.
- Indian lacing is the sewing or lacing of the lower lateral band with inner core or line which is secured to the bipod poles. This will remove the remaining wrinkles and further tighten the material.
- A rain fly, bed, and other refinements can now be added.

Poncho Lean-To

It takes only a short time and minimal equipment to build this lean-to. You need a sturdy, smooth, ridge pole (longer than the builder's body) long enough to span the distance between two sturdy trees. You will also need support poles, stakes, suspension lines, buttons, and fabric or parachute material.

Before selecting the trees you will use or the location of your poles, check the wind direction. Ensure that the back of your lean-to will be into the wind.

Assembling the Framework:

- Lash the ridge pole (between two suitable trees) about chest or shoulder high.
- Lay the roof support poles on the ridge pole so the roof support poles and the ground are at approximately a 60-degree angle. Lash the roof support poles to the ridge pole.

Applying the Fabric:

- Place the middle seam of the fabric on the middle support pole with lower lateral band along the ridge pole.
- Tie-off the middle and both sides of the lower lateral band approximately 8 to 10 inches from the ridge pole.
- Stake the middle of the rear of the shelter first, then alternate from side to side.
- The stakes that go up to the sides to the front should point to the front of the shelter.

- Pull the lower lateral band closer to the ridge pole by Indian lacing.
- Add bed and other refinements (reflector fire, bed logs, rain fly, etc.). See figure 2-30 for lean-to examples.

For additional protection from wind and rain, place some brush, your rucksack, or other equipment at the sides of the lean-to.

To reduce heat loss to the ground, place some type of insulating material, such as leaves or pine needles, inside your lean-to.

Note: *When at rest, you lose as much as 80 percent of your body heat to the ground.*

Nine-Pole Parachute Tepee

The tepee is an excellent shelter for protection from wind, rain, cold, and insects. Cooking, eating, sleeping, resting, signaling, and washing can all be done without going outdoors. The tepee, whether 9-pole, 1-pole, or no-pole, is the only improvised shelter that provides adequate ventilation to build an inside fire. With a small fire inside, the shelter also serves as a signal at night.

Materials:

- Suspension line.
- Fabric or parachute material.
- Stakes.
- Although any number of poles may be used, 11 poles, smoothed off, each about 20 feet long, will normally provide adequate support.

Assembling the Framework:

Assume 11 poles are used. Adjust instructions if different numbers are used.

- Lay three poles on the ground with the butts even. Stretch the canopy along the poles. The lower lateral band should be 4 to 6 inches from the bottoms of the poles before the stretching takes place. Mark one of the poles at the apex point.
- Lash the three poles together, 5 to 10 inches above the marked area. (A shear lash is effective for this purpose.) These poles will form the tripod (fig. 2-31).
- Draw a circle approximately 12 feet in diameter in the shelter area and set the tripod so the butts of the poles are evenly spaced on the circle. Five of the remaining eight poles should be placed so the butts are evenly spaced around the 12-foot circle and the tops are laid in the apex of the tripod to form the smallest apex possible.

Applying the Fabric:

- Stretch the parachute material along the tie pole. Using the suspension line attached to the middle radial seam, tie the lower lateral band to the tie pole 6 inches from the butt end. Stretch the parachute material along the middle radial seam and tie it to the tie pole using the suspension line at the apex. Lay the tie pole onto the shelter frame with the butt along the 12-foot circle and the top in the apex formed by the other poles. The tie pole should be placed directly opposite the proposed door.
- Move the canopy material (both sides of it) from the tie pole around the framework and tie the lower lateral band together and stake it at the door. The front can now be sewn or pegged closed, leaving 3 to 4 feet for a door. (A sewing “ladder” can be made by lashing steps up the front of the tepee (fig. 2-31.4).
- Enter the shelter and move the butts of the poles outward to form a more perfect circle and until the fabric is relatively tight and smooth.
- Tighten the fabric and remove remaining wrinkles. Start staking directly opposite the door, and alternate from side to side, pulling the material down and to the front of the shelter. Use clove hitches or similar knots to secure material to the stakes.
- Insert the final two poles into the loops on the smoke flaps. The tepee is now finished (fig. 2-31.5).
- One improvement which could be made to the nine-pole tepee is the installation of a liner. This will allow a draft for a fire without making the occupants cold, since there may be a slight gap between the lower lateral band and the ground. A liner can be affixed to the inside of the tepee by taking the remaining 14-gore piece of material and firmly staking the lower lateral band directly to the ground all the way around, leaving room for the door. The area where the liner

and door meet may be sewn up. The rest of the material is brought up the inside walls and affixed to the poles with buttons.

Three-Pole Parachute Tepee

If you have a parachute and three poles and the tactical situation allows, make a parachute tepee. It is easy and takes very little time to make this tepee. It provides protection from the elements and can act as a signaling device by enhancing a small amount of light from a fire or candle. It is large enough to hold several people and their equipment and to allow sleeping, cooking, and storing firewood.

You can make this tepee using parts of or a whole personnel main or reserve parachute canopy. If using a standard personnel parachute, you need three poles 3.5 to 4.5 meters long and about 5 centimeters in diameter.

Assembling the Framework:

- Lay the poles on the ground and lash them together at one end.
- Stand the framework up and spread the poles to form a tripod.
- For more support, place additional poles against the tripod. Five or six additional poles work best, but do not lash them to the tripod.
- Determine the wind direction and locate the entrance 90 degrees or more from the mean wind direction.

Applying the Fabric:

- Lay out the parachute on the "backside" of the tripod and locate the bridle loop (nylon web loop) at the top (apex) of the canopy.
- Place the bridle loop over the top of a free-standing pole. Then place the pole back up against the tripod so that the canopy's apex is at the same height as the lashing on the three poles.
- Wrap the canopy around one side of the tripod. The canopy should be of double thickness, as you are wrapping an entire parachute. You need only wrap half of the tripod, as the remainder of the canopy will encircle the tripod in the opposite direction.
- Construct the entrance by wrapping the folded edges of the canopy around two free-standing poles. You can then place the poles side by side to close the teepee's entrance.
- Place all extra canopy underneath the tepee poles and inside to create a floor for the shelter.
- Leave a 30- to 50-centimeter opening at the top for ventilation if you intend to have a fire inside the tepee.

One-Pole Tepee

You need a 14-gore section (normally) of canopy, stakes, a stout center pole, and inner core and needle to construct this tepee. You cut the suspension lines except for 40- to 45-centimeter lengths at the canopy's lower lateral band.

Assembling the Framework:

- Select a shelter site and draw a circle about 14 feet in diameter on the ground.
- The parachute material is staked to the ground using the lines attached at the lower lateral band. After deciding where the shelter door will be located, stake the first line (from the lower band) down securely. Proceed around the circle that was drawn and stake down all the lines from the lateral band, making sure the parachute material is stretched tight before the line is staked down.
- Once all the lines are staked down, loosely attach the center pole, and through trial and error, determine the point at which the parachute material will be pulled tight once the center pole is placed upright—securely attach the material at this point.
- Using a suspension line (or innercore), sew the end of the material together leaving 3 or 4 feet for a door (fig. 2-32).

Parachute Tepee

No-Pole

For this shelter, you use the same materials, except for the center pole, as for the one-pole parachute tepee.

Assembling the Framework (fig. 2-33):

- Tie a line to the top of parachute material with a previously cut suspension line.
- Throw the line over a tree limb, and tie it to the tree trunk.
- Starting at the opposite side from the door, place a stake on the drawned 3.5- to 4.3-meter circle.
- Tie the first line on the lower lateral band.
- Continue emplacing the stakes and tying the lines to them.
- After staking down the material, unfasten the line tied to the tree trunk, tighten the tepee material by pulling on this line, and tie it securely to the tree trunk.

Sod Shelter

A framework covered with sod provides a shelter which is warm in cold weather and one that is easily made waterproof and insect-proof in the summer. The framework for a sod shelter must be strong, and it can be made of driftwood, poles, willow, etc. (Some natives use whale bones.) Sod, with a heavy growth of grass or weeds, should be used since the roots tend to hold the soil together. Cutting about 2 inches of soil along with the grass is sufficient. The size of the blocks are determined by the strength of the individual. A sod house is strong and fireproof.

Shelters for Tropical Areas

In tropical areas, especially moist tropical areas, the major environmental factors influencing both site selection and shelter types are:

- Moisture and dampness.
- Rain.
- Wet ground.
- Heat.
- Mud-slide areas.
- Dead standing trees and limbs.
- Insects.

Survivors should establish a campsite on a knoll or high spot in an open area well back from any swamps or marshy areas. The ground in these areas is drier, and there may be a breeze which will result in fewer insects. Underbrush and dead vegetation should be cleared from the shelter site. Crawling insects will not be able to approach survivors easily due to lack of cover. A thick bamboo clump or matted canopy of vines for cover reflects the smoke from the campfire and discourages insects. This cover will also keep the extremely heavy early morning dew off the bedding.

The easiest improvised shelter is made by draping a parachute, tarpaulin, or poncho over a rope or vine stretched between two trees. One end of the canopy should be kept higher than the other. Insects are discouraged by few openings in shelters and smudge fires. A hammock made from parachute material or fabric will keep the survivor off the ground and discourage ants, spiders, leeches, scorpions, and other pests.

In the wet jungle, survivors need shelter from dampness. If they stay with the aircraft, it should be used for shelter. They should try to make it mosquito proof by covering openings with netting or parachute cloth.

A good rain shelter can be made by constructing an A-type framework and covering it with a good thickness of palm or other broad leaf plants, pieces of bark, and mats of grass (fig. 2-34).

Nights are cold in some mountainous tropical areas. Survivors should try to stay out of the wind and build a fire. Reflecting the heat off a rock pile or other barrier is a good idea. Some natural materials which can be used in the shelters are green wood (dead wood may be too rotten), bamboo, and palm leaves. Vines can be used in place of suspension line for thatching roofs or floors, etc. Banana plant sections can be separated from the banana plant and fashioned to provide a mattress effect.

Raised Platform Shelter

The raised platform shelter has many variations. One example is four trees or vertical poles in a rectangular pattern which is a little longer and a little wider than the survivor, keeping in mind the survivor will also need protection for equipment. Two long, sturdy poles are then square lashed between the trees or vertical poles, one on each side of the intended shelter. Cross pieces can then be

secured across the two horizontal poles at 6- to 12-inch intervals. This forms the platform on which a natural mattress may be constructed. Parachute material can be used as an insect net and a roof can be built over the structure using A-frame building techniques. The roof should be waterproofed with thatching laid bottom to top in a thick shingle fashion. See figure 2-35 for examples of this and other platform shelters. These shelters can also be built using three trees in a triangular pattern. At the foot of the shelter, two poles are joined to one tree.

Raised Parachute Platform Shelter. A variation of the platform-type shelter is the parachute platform. A quick and comfortable bed is made by simply wrapping material around the two "frame" poles. Another method is to roll poles in the material in the same manner as for an improvised stretcher (fig. 2-36).

Hammocks. Various parachute hammocks can also be made. They are more involved than a simple parachute wrapped framework and not quite as comfortable (fig. 2-37). You can make a hammock using 6 to 8 gores of parachute canopy and two trees about 4.5 meters apart.

Hobo Shelter

On tropical coasts and other coastal environments, if a more permanent shelter is desired as opposed to a simple shade shelter, survivors should build a “hobo” shelter. To build this shelter:

- Dig into the lee side of a sand dune to protect the shelter from the wind. Clear a level area large enough to lie down in and store equipment.
- After the area has been cleared, build a heavy driftwood framework which will support the sand.
- Wall sides and top with strong material (boards, driftwood, etc.) that will support the sand; leave a door opening.
- Slope the roof to equal the slope of the sand dune. Cover the entire shelter with parachute material to keep sand from sifting through small holes in the walls and roof.

Silt: A sedimentary material consisted of fine mineral particles intermediate in size between sand and clay.

- Cover with 6 to 12 inches of sand to provide protection from wind and moisture.
- Construct a door for the shelter (fig. 2-38).

Swamp Bed

In a marsh or swamp, or any area with standing water or continually wet ground, the swamp bed (fig. 2-39) keeps you out of the water. When selecting such a site, consider the weather, wind, tides, and available materials.

To make a swamp bed:

- Look for four trees clustered in a rectangle, or cut four poles (bamboo is ideal) and drive them firmly into the ground so they form a rectangle. They should be far enough apart and strong enough to support your height and weight, to include equipment.
- Cut two poles that span the width of the rectangle. They, too, must be strong enough to support your weight.
- Secure these two poles to the trees (or poles). Be sure they are high enough above the ground or water to allow for tides and high water.
- Cut additional poles that span rectangle’s length. Lay them across the two side poles, and secure them.
- Cover the top of the bed frame with broad leaves or grass to form a soft sleeping surface.
- Build a fire pad by laying clay, **silt**, or mud on one corner of the swamp bed and allow it to dry.

Another shelter designed to get you above and out of the water or wet ground uses the same rectangular configuration as the swamp bed. You very simply lay sticks and branches lengthwise on the inside of the trees (or poles) until there is enough material to raise the sleeping surface above the water level.

Shelters for Dry Climates

Natives of hot, dry areas make use of light-proof shelters with sides rolled up to take advantage of any breeze. Survivors should imitate these shade-type shelters if forced to survive in these areas. The extremes of heat and cold must be considered in hot areas, as most can become very cold during the night. The major problem for survivors will be escaping the heat and sun rays.

Natural Shelters

Do not overlook natural formations that provide shelter. Examples are caves, rocky crevices, clumps or bushes, small depressions, large rocks on leeward sides of hills, large trees with low-hanging limbs, and fallen trees with thick branches. However, when selecting a natural formation:

- Stay away from low ground such as ravines, narrow valleys, or creek beds. Low areas collect the heavy cold air at night and are therefore colder than the surrounding high ground. Thick, brushy, low ground also harbors more insects.
- Check for poisonous snakes, ticks, mites, scorpions, and stinging ants.
- Look for loose rocks, dead limbs, coconuts, or other natural growth that could fall on your shelter.

In some desert mountains, it is possible to find good rock shelters or cave-like protection under tumbled blocks of rocks which have fallen from cliffs. Use care to ensure that these blocks are in areas void of future rock falling activity and free from animal hazards.

Vegetation, if any exists, is usually stunted and armed with thorns. It may be possible to stay in the shade by moving around the vegetation as the Sun moves. The hottest part of the day may offer few shadows because the Sun is directly overhead. Parachute material draped over bushes or rocks will provide some shade.

Debris Hut

For warmth and ease of construction, this shelter is one of the best. When shelter is essential to survival, build this shelter.

To make a debris hut (fig. 2-40):

- Build it by making a tripod with two short stakes and a long ridgepole or by placing one end of a long ridgepole on top of a sturdy base.
- Secure the ridgepole (pole running the length of the shelter) using the tripod method or by anchoring it to a tree at about waist height.
- Prop large sticks along both sides of the ridgepole to create a wedge-shaped ribbing effect. Ensure the ribbing is wide enough to accommodate your body and steep enough to shed moisture.
- Place finer sticks and brush crosswise on the ribbing. These form a latticework that will keep the insulating material (grass, pine needles, leaves) from falling through the ribbing into the sleeping area.
- Add light, dry, if possible, soft debris over the ribbing until the insulating material is at least 1 meter thick—the thicker the better.
- Place a 30-centimeter layer of insulating material inside the shelter.
- At the entrance, pile insulating material that you can drag to you once inside the shelter to close the entrance or build a door.
- As a final step in constructing this shelter, add shingling material or branches on top of the debris layer to prevent the insulating material from blowing away in a storm.

Beach Shade Shelter

This shelter protects you from the sun, wind, rain, and heat. It is easy to make using natural materials.

To make this shelter (fig. 2-41):

- Find and collect driftwood or other natural material to use as support beams and as a digging tool.

- Select a site that is above the high water mark.
- Scrape or dig out a trench running north to south so that it receives the least amount of sunlight. Make the trench long and wide enough for you to lie down comfortably.
- Mound soil on three sides of the trench. The higher the mound, the more space inside the shelter.
- Lay support beams (driftwood or other natural material) that span the trench on top of the mound to form the framework for a roof.
- Enlarge the shelter's entrance by digging out more sand in front of it.
- Use natural materials such as grass or leaves to form a bed inside the shelter.

Desert Shelters

In an arid environment, consider the time, effort, and material needed to make a shelter. If you have material such as a poncho, canvas, or a parachute, use it along with such land features as rock outcroppings, mounds of sand, or a depression between dunes or rocks to make your shelter.

Using rock outcroppings:

- Anchor one end of your poncho (canvas, parachute, or other material) on the edge of the outcrop using rocks or other weights.
- Extend and anchor the other end of the poncho so it provides the best possible shade.

In a sandy area:

- Build a mound of sand or use the side of a sand dune for one side of the shelter.
- Anchor one end of the material on top of the mound using sand or other weights.
- Extend and anchor the other end of the material so it provides the best possible shade.

Note: *If you have enough material, fold it in half and form a 30-centimeter to 45-centimeter airspace between the two halves.*

Belowground Shelter:

This airspace will reduce the temperature under the shelter.

A **belowground shelter** (fig. 2-42) can reduce the midday heat as much as 16 to 22ºC (30 to 40ºF). Building it, however, requires more time and effort than for other shelters. Since your physical effort will make you sweat more and increase dehydration, construct it before the heat of the day.

To make this shelter:

- Find a low spot or depression between dunes or rocks. If necessary, dig a trench 45 to 60 centimeters deep and long and wide enough for you to lie in comfortably.
- Pile the sand you take from the trench to form a mound around three sides.
- On the open end of the trench, dig out more sand so you can get in and out of your shelter easily.
- Cover the trench with your material.
- Secure the material in place using sand, rocks, or other weights.

If you have extra material, you can further decrease the midday temperature in the trench by securing the material 30 to 45 centimeters above the other cover. This layering of the material will reduce the inside temperature 11 to 22ºC (20 to 40ºF).

Principles of Desert Shelters

Another type of belowground shade shelter is of similar construction, except all sides are open to air currents and circulation. For maximum protection, you need a minimum of two layers of parachute or canopy material (fig. 2-43). White is the best color to reflect heat; the innermost layer should be of darker material.

Materials that can be used to build desert shelters include the following:

- Sand, though difficult to work with when loose, may be made into pillars by using sandbags made from any available cloth.
- Rock can be used in shelter construction.
- Vegetation such as sagebrush, creosote bushes, juniper trees, and desert gourd vines are valuable building materials.
- Canopy and suspension lines are perhaps the most versatile building materials available. When used in layers, fabric protects you from the Sun's rays.

The shelter should be made of dense material or have numberous layers to reduce dangerous ultraviolet rays. The color of the materials used make a difference as to how much protection is provided from ultraviolet radiation. As a general rule, the order of preference should be to use as many layers as practical in the order of orange, green, tan, and white.

Ultraviolet Tests on Parachute Canopy Material

% Ultraviolet (Short Wave 2537 Aº Sunburn Rays) Blocked as compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	78.2%	96.2%	99.36%
Sage Green	79.5%	96.2%	98.7%
Tan	64.1%	84.6%	93.6%
White	47.5%	61.6%	70.5%

% Ultraviolet (Long Wave 3660 Aº) Blocked as Compared to Direct Exposure

	1 Layer	2 Layers	3 Layers
Orange	63.4%	92.3%	97.8%
Sage Green	60.0%	88.95%	97.8%
Tan	38.9%	66.7%	82.3%
White	28.9%	47.8%	58.9%

The roof of a desert shelter should be multilayered so the resulting airspace reduces the inside temperature of the shelter. The layers should be separated 12 to 18 inches apart (fig. 2-43).

Survivors should place the floor of the shelter about 18 inches above or below the desert surface to increase the cooling effect.

In warmer deserts, white material should be used as an outer layer. Orange or sage green material should be used as an inner layer for protection from ultraviolet rays. In cooler areas, multiple layers of material should be used with sage green or orange material as the outer layer to absorb heat. The sides of shelters should be movable in order to protect survivors during cold and windy periods, and to allow for ventilation during hot periods.

In a hot desert, shelters should be built away from large rocks which store heat during the day. Survivors may need to move to the rocky areas during the evening to take advantage of the warmth heated rocks radiate.

Build desert shelters on the windward sides of dunes for cooling breezes. It is best to build shelters during early morning, late evening, or at night. However, potential survivors should recall that survivors who come down in a desert area during daylight hours must be immediately concerned with protection from the Sun and loss of water. In this case, canopy material can be draped over a liferaft, vegetation, or a natural terrain feature for quick shelter.

Aircraft parts and liferafts are also good improvised shade shelters. Survivors may use sections of the wing, tail, or fuselage to provide shade. However, the interior of the aircraft will quickly become super-heated and should be avoided as a shelter. An inflatable raft can be tilted against a raft paddle or natural object such as a bush or rock to provide relief from the Sun (fig. 2-44).

Shelters for Snow and Ice Areas

The differences in arctic and arctic-like environments create the need for different shelters. Basically, there are two types of environments which may require special shelter characteristics or building principles before survivors will have adequate shelter.

They are:

- Barren lands which include some seacoasts, icecaps, sea ice areas, and areas above the tree line.
- Tree-line areas.

Barren lands offer a limited variety of materials for shelter construction. These are snow, small shurbs, and grasses. Ridges formed by drifting or wind-packed snow may be used for wind protection (survivors should build on the lee side). In some areas, such as sea ice, windy conditions usually exist and cause the ice to shift forming pressure ridges. These areas of unstable ice and snow should be avoided at all times.

Shelters which are suitable for barren-type areas include:

1. Molded dome. (fig. 2-45)
2. Snow cave. (fig. 2-46)
3. Fighter trench.(fig. 2-47)
4. Igloo. (fig. 2-48)
5. Para-snow house. (fig. 2-49)

Note: Of these, the ones that are quick to construct and require minimum effort and energy are the molded dome, snow cave, and fighter trench. It is important to know which of these shelters is the easiest to build since reducing or eliminating the effect of the wind-chill factor is essential to remaining alive.

In tree-covered areas, plenty of natural shelter building materials are normally available. Caution is required. Shelters built near rivers and streams may get caught in the overflow.

Tree-line area shelter types include:

1. Thermal A-frame construction. (fig. 2-50).
2. Lean-to or wedge. (fig. 2-51).
3. Double lean-to. (fig. 2-52).
4. Fan. (fig. 2-53).
5. Willow frame. (fig. 2-54).
6. Tree well. (fig. 2-55).

Regardless of the type of shelter used, the use of thermal principles and insulation in arctic shelters is required. Heat glows from bare ground and from ice masses over water. This means that shelter areas on land should be dug down to bare earth if possible (fig. 2-56). A minimum of 8 inches of insulation above survivors is needed to retain heat. All openings except ventilation holes should be sealed to avoid heat loss. Leaving vent holes open is especially important if heat producing devices are used. Candles, sterno, or small oil lamps produce carbon monoxide. In addition to the ventilation hole through the roof, another may be required at the door to ensure enough circulation of air. (As a general rule, unless persons can see their breath, the snow shelter is too warm and should be cooled down to preclude melting and dripping.)

Regardless of how cold it may get outside, the temperature inside a small well-constructed snow cave will probably not be lower than -10°F. Body heat alone can raise the temperature of a snow cave 45 degrees above the outside air. A burning candle will raise the temperature 4 degrees. Burning sterno stove (small size, $2^5/_8$ oz) will raise the cave temperature about 28 degrees. However, since they cannot be heated many degrees above freezing, snow shelters provide a rather rugged life. Once the inside of the shelter "glazes" over with ice, this layer of ice should be removed by chipping it off or a new shelter built since ice reduces the insulating quality of a shelter. Maintain the old shelter until the new one is constructed. It will provide protection from the wind.

The aircraft should not be used as a shelter when temperatures are below freezing except in high wind conditions. Even then a thermal shelter should be constructed as soon as the conditions improve. The aircraft will not provide enough insulation, and the floor will usually become icy and dangerous.

General Construction Techniques

All thermal shelters use a layering system consisting of the frame, parachute (if available), boughs or shrubs, and snow. The framework must be sturdy enough to support the cover and insulation. A door block should be used to minimize heat loss. Insulation should be added on sleeping areas.

If a barren land-type shelter is being built with snow as the only material, a long knife or digging tool is a necessity. It normally takes 2 to 3 hours of hard work to dig a snow cave, and much longer for the beginner to build an igloo.

Survivors should dress lightly while digging and working; they can easily become overheated and dampen their clothing with perspiration which will rapidly turn to ice.

If possible, all shelter types should have their openings 90 degrees to the prevailing

wind. The entrance to the shelter should also be screened with snowblocks stacked in a L-shape.

Snow on the sea ice, suitable for cutting into blocks, will usually be found in the lee of pressure ridges or ice mounds. The packed snow is often so shallow that the snowblocks have to be cut out horizontally.

No matter which shelter is used, survivors should take a digging tool into the shelter at night to cope with the great amount of snow which may block the door during the night.

Shelter living

Survivors should limit the number of shelter entrances to conserve heat. Fuel is generally scarce in the arctic. To conserve fuel, it is important to keep the shelter entrance sealed as much as possible (fig. 2-57). When it is necessary to go outside the shelter, activities such as gathering fuel, snow or ice for melting, etc., should be done. To hurry matters, a trash container may be kept inside the door, and equipment may be stored in the entry way. Necessities which cannot be stored inside may be kept just outside the door. Any firearms (guns) the survivor may have must be stored outside the shelter to prevent increasing pressure building which could cause them to malfunction.

A standard practice in snow shelter living is for people to relieve themselves indoors when possible. This practice conserves body heat. If the snowdrift is large enough to dig connecting snow caves, one may be used as a toilet room. If not, tin cans may be used for urinals, and snowblocks for solid wastes (fecal) matter.

Survivors should use thick insulation under themselves when sleeping or resting even if they have a sleeping bag. They can use a thick bough bed in shingle-fashion, seat cushions, parachute, or an inverted inflated rubber raft.

Outer clothing makes good mattress material. A parka makes a good footbag. The shirt and inner trousers may be rolled up for a pillow. Socks and insoles can be separated and aired in the shelter. Drying may be completed in the sleeping bag by stowing around the hips. This drying method should only be used as a last resort.

Keeping the sleeping bag clean, *dry*, and fluffed will give maximum warmth. To dry the bag, it should be turned inside out, frost beaten out, and warmed before the fire—taking care that it doesn't burn.

To keep moisture (from breath) from wetting the sleeping bag, a moisture cloth should be improvised from a piece of clothing, a towel, or parachute fabric. It can then be lightly wrapped around the head in such a way that the breath is trapped inside the cloth. A piece of fabric dries easier than a sleeping bag. If cold is experienced during the night, survivors should exercise by fluttering their feet up and down or by beating the inside of the bag with their hands. Food or hot liquids can be helpful.

Snow remaining in clothing will melt in a warm shelter. When the clothing is again taken outside, the water formed will turn to ice and reduce the CLo value. Brush clothes before entering the shelter. Under living conditions where drying clothing is difficult, it is easier to keep clothing from getting wet than having to dry it out later.

If all the snow cannot be eliminated from outer clothing, survivors should remove the clothing and store it in the entry way or on the floor away from the source of heat so it remains cold. If ice should form in clothing, it may be beaten out with a stick.

In the cramped quarters of any small emergency shelter, pots of food or drink can be accidentally kicked over. The cooking area, even if it is only a sterno stove, should be located out of the way.

Shelter for Open Seas

Personal protection from the elements is just as important on the seas as it is anywhere else. Some rafts come equipped with insulated floors, spray shields**,** and canopies to protect survivors from heat, cold**,** and water. If rafts are not so equipped or the equipment has been lost, survivors should try to improvise these items using parachute material, clothing, or other equipment.